Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 25 FEBRUARY, 1916 No. 2

Ship's Under-Water Eye Sights Hidden Mines

TO assist battleships and destroyers in locating submerged mines, an American has developed an under-sea searchlight equipment which, when used in conjunction with a special water glass, makes it possible to distinguish objects at a distance of 2,000 ft. A powerful electric lamp is mounted on one side of a vessel below the water line, at its bow. This may be turned to different angles by an operator on deck. Immediately forward of this is the glass, similar to a modified periscope, forming the ship's under-sea eye and used to follow the illuminated path. When a mine is located in a vessel's course a torpedo is launched which may be discharged electrically. This is watched and at the proper instant detoned, thus exploding the mine. It is believed that the device could also be used on mine sweepers to advantage.

While Particularly Valuable for a Battleship, the Under-Sea Searchlight Also Offers Merchant Vessels Protection in Danger Zones. To Give a Clear View of the Apparatus the Artist Shows the Ship in Close Proximity to the Submerged Mine

BLIND BOYS ARE TRAINED TO SHINE SHOES

In an attempt to assist blind persons to make themselves self-supporting, a westerner has designed a bootblack stand and made working paraphernalia

Bootblack Stand Arranged to Enable Blind Boys to Shine Shoes and Make Themselves Self-Supporting

which enable a boy, or man, deprived of sight to polish shoes after a short apprenticeship. The chief difference between this stand and others is that separate compartments are provided between the chairs for the polish, brushes, and cloths used on shoes of different colors. Ankle shields made of waterproof material fixed to trouser guards are used to protect a patron's hose from being soiled when work is done on low shoes. In order that the blind operators may be able to handle the liquid with which boots are first treated, soap dispensers have been modified and are used in place of the usual type of dauber. For advertising purposes an illuminated sign in Braille characters as well as English is employed. The man has trained a few blind boys to do this kind of work, and for these he has prepared badges which indicate whether a worker is totally, or merely partially, blind. It is only necessary for a patron to take a seat and inform an operator whether his shoes are tan or black.

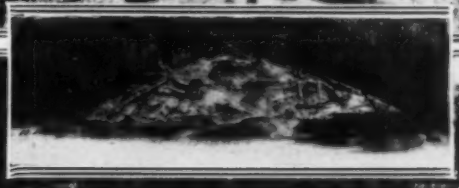
BEAVER DAMS WORK TROUBLE ALONG RAILWAY LINE

In certain parts of Wisconsin beavers have increased rapidly during the last few years, owing to the enforcement of rigid laws for their protection. As a result a serious as well as an amusing situation has arisen in Oneida County, along Bear Skin and Rucky Run creeks, where great numbers of the industrious little animals have built a series of large dams that have backed up the stream and caused the tracks of the Chicago, Milwaukee and St. Paul Railway to be flooded and damaged.

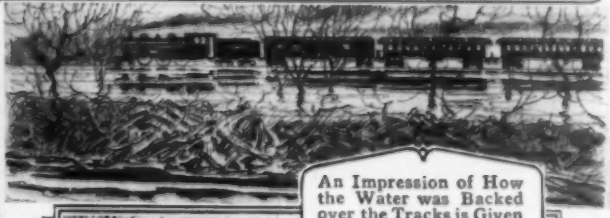
Following heavy rains some time ago Bear Skin Creek rose at several points west of Goodnow, covering the railroad's right of way. When the water failed to recede, an investigation showed that a beaver dam, and not the rain, was responsible for the trouble. Since it is contrary to the statutes to destroy these works, the assistance of the conservation commission had to be enlisted before the condition could be rectified. The state game warden subsequently superintended the destruction of the dam, which had backed up a 6-ft. head of water. Owing to the substantial construction of this blockade, ten separate blasts of dynamite were required to clear it away.

Two or three weeks after this was accomplished it again became necessary to destroy a dam at the same place, for during the interim the beavers had reconstructed it. The same condition prevails at the present writing, and it is a matter of but a very short time until this obstruction will need to be eliminated. Since the animals apparently refuse to be discouraged in building at this particular point it is considered possible that

Above is Shown One of the Beavers' Chopping Grounds, While at the Right Is a Typical House Constructed by These Industrious Little Animals



A Sluiceway through Which Beavers Floated Logs to One of the Dams. Above, in the Middle, a Beaver is to be Seen in One of the Chopping Grounds



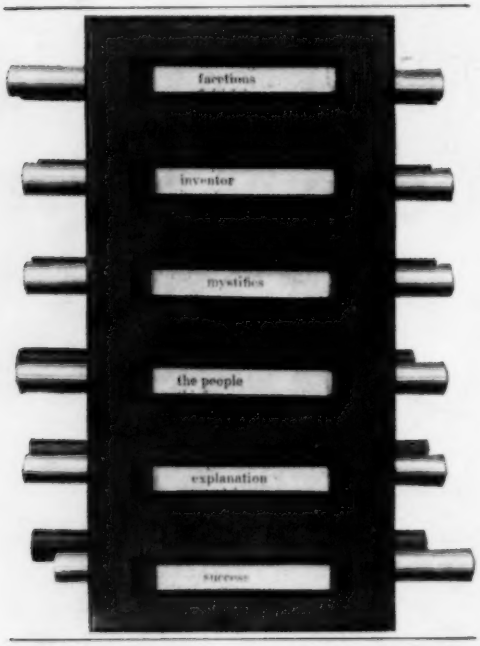
An Impression of How the Water was Backed over the Tracks is Given Above, and Below is Shown a Section of the Longest Dam on Rucky Run Creek

steps will have to be taken to trap them and remove them to another place so that their work will not menace the railroad. The population of this specific colony is not accurately known, but the extent of the work suggests that there may be 500 or more of the animals in that immediate locality.

The largest dam on the Bear Skin is 75 ft. in length and is now built to a height of about two feet above the water. On Rucky Run there are several dams, the largest of which is 310 ft. long. This is of water-tight construction and is provided at either end with small sluiceways. Between this structure and the railway company's right of way, a distance of a mile and a half, are eight other dams which will eventually have to be removed to protect the trackage from being inundated at different points.

MOVIE AND STORY PLOTS BUILT BY MACHINE

By the invention of an "idea box," a Cambridge, Mass., writer has developed a mechanical device which creates

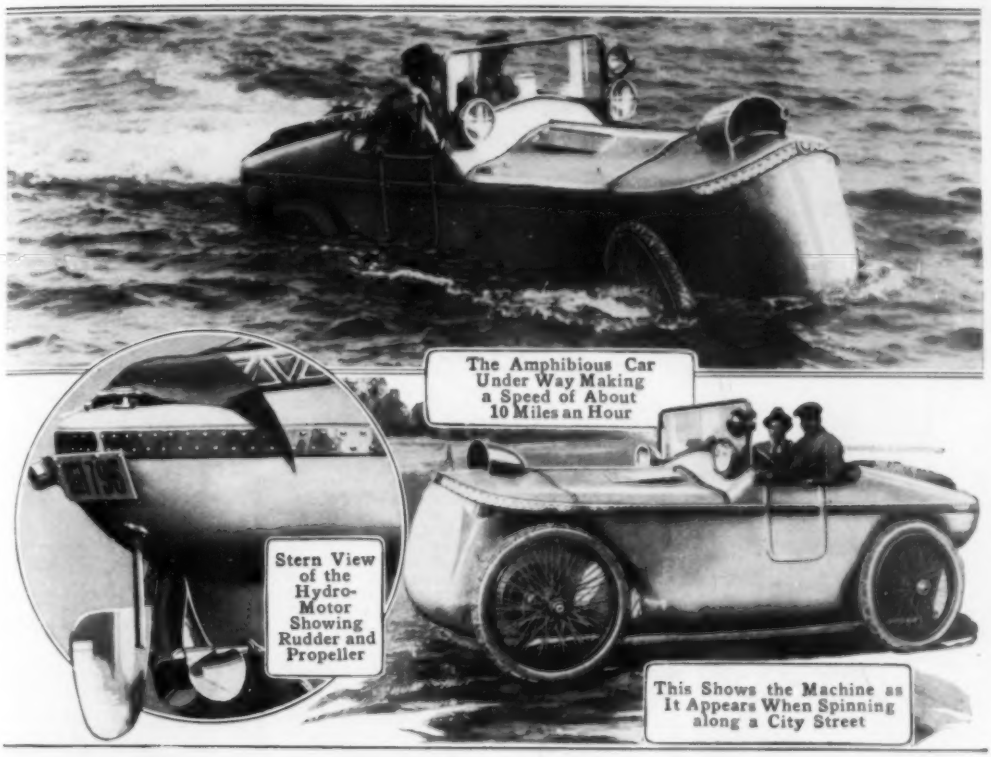


The "Idea Box" Which Turns Out an Endless Number of Situations and Plots for Movie and Story Purposes

plots for movie scenarios, plays, and short stories; originates comic, melodramatic, and tragedy situations, and serves as an efficient substitute for an overworked or underdeveloped imagination. Although few things would seem more ludicrous than the thought of building the skeleton of a literary production by turning a crank, this is the very function performed, and surprisingly well, by this latest brain-replacing machine. It permits a staid clerk or an inspirationless schoolgirl to turn out fiction or moving-picture plots galore.

It is not a toy. Apparently it is meritorious. It consists of a pasteboard box, 3 in. wide, 6 in. long, and 2 in. thick, fitted with a half-dozen pairs of spindles on each of which a roll of paper carrying a long, printed list of words is wound. In the cover of the box are six slots through which one word on each roll may be read. Altogether about 1,200 different words are listed. These are classified into six separate groups, such as nouns, verbs, adjectives, and so on. The ends of the spindles extend through the sides of the box, and by turning any one of them different words appear one after another in one of the cover openings.

The machine is operated by turning the spindles in the order they come until words which make sense when read from top to bottom are grouped. By a few turns of each roll combinations such as these are given: Beautiful-Widow-Marries-President-Inspiration-Election; Brilliant-Atheist-Corrupts - Clergyman - Change - Outcast; Eccentric - Spinster - Adopts - Burglar-Excitement-Marriage. Each of these furnishes a central idea, or skeleton, for a scenario or story. The basic theory of the device is thus shown to be that actions and thoughts can be dissolved into a word formula, and the words rearranged mechanically to the formation of other, and original, thoughts and actions.


The Amphibious Car Under Way Making a Speed of About 10 Miles an Hour
Stern View of the Hydro-Motor Showing Rudder and Propeller
This Shows the Machine as It Appears When Spinning along a City Street

HYDRO-MOTOR CAR DESIGNED FOR LAND AND WATER

Tests which resulted very satisfactorily were recently conducted at San Francisco with an amphibious motor car constructed by a local concern. At its debut it was driven off the beach into the bay, where it navigated nicely at a speed of about 10 miles an hour for a time and then climbed ashore without hesitation. The machine is a high-power roadster fitted with a boat-shaped aluminum body and provided at the stern with a screw propeller and rudder. The gears are shifted to drive the marine propulsion shaft and the rudder controlled by the steering wheel when the car slips into the water and its driving wheels lose their purchase on the earth. The car sits well in the water and looks much like a blunt-nosed motorboat. This appearance is only somewhat modified when it is propelled over land. The machine travels easily along average roads.

TEETH ON END OF SAW HOLD IT UPRIGHT

Handsaws have a way of slipping and falling to the floor when temporarily leaned against the wall or sawhorse, making it necessary for the carpenter to stoop and pick them up many times a day. To prevent this inconvenience a saw with two small teeth on the end of the blade has been invented. The latter catch in the floor when the saw is standing upright, and prevent the tool from slipping. Even a very small support is sufficient to keep the saw erect, if the points on the end of the blade are pushed into the wood. Except for the extra teeth, the saw is like any other.

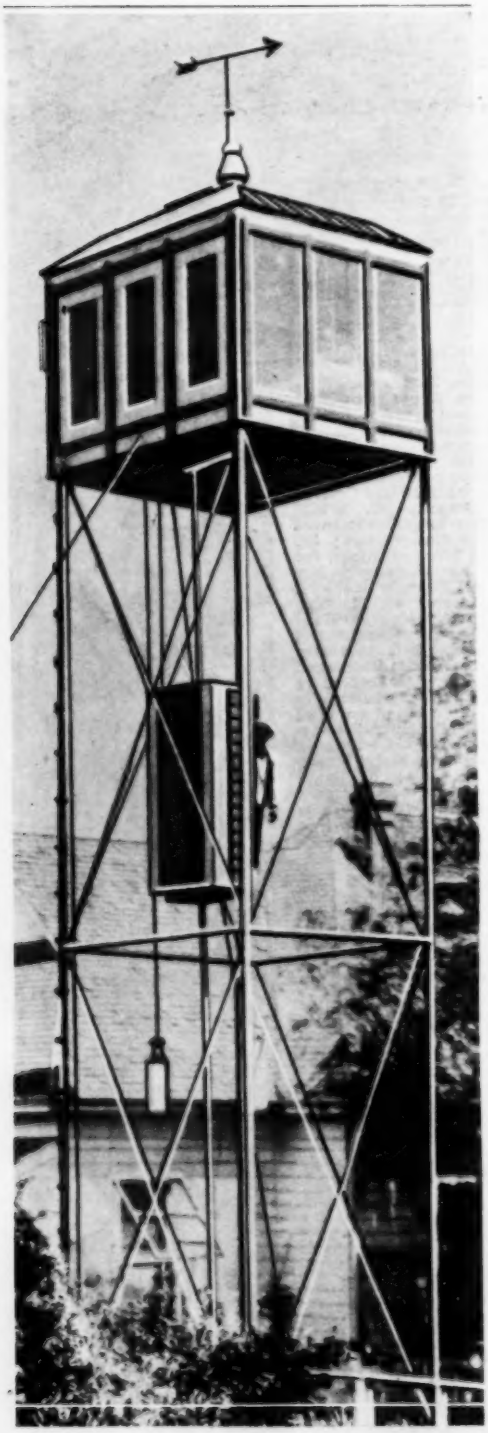
STRIKING DESIGNS IN BRIGHTLY HUED CAGES,

1, Bird Cage on Metal Standard Ornamented with Flower Holders and Artificial Birds; 2, Flower Holder Fastened to Wall or Glass by Vacuum Cups; 3, Hanging Basket of Fine Woven Reed, Metal Lined; 4, Goldfish Bowl with Gilt Festoons of Composition, on Ornamental Stand; 5, Aquarium Decorated with Bright Designs; 6, Olive-Green Vase with Live Pine Tree; 7, Painted Porcelain Cock for Decoration; 8, Garden Stick Supporting Brightly Colored Bird of Carved Wood; 9, Sticks for Supporting Plants in Flowerpots; 10, Painted Porcelain Bird; 11, Painted Aquarium on Brown Reed Standard; 12, Flower Tray, Filled with Water and Pond Lilies; Butterflies Suspended from Rim on Springs; 13, Crab and Pond Lilies for Flower Trays; 14, Japanese Incense Holders; 15, Green Crescent-Shaped Flower Basket Suspended in Reed Mesh; 16, White Enamel Reed Bird Cage on Wooden Standard Festooned with Colored Flowers of Composition; 17, Miniature Flower Holder, Supported by Vacuum Cups; 18, White Enamel Flower Basket with Colored Festoons of Composition, Metal Lined; 19, Woven Reed Window Box Decorated and Metal Lined, on Substantial Metal Standard; 20, Glass Flower Tray in Outline Like Four-Leafed Clover, with Flower Holder and Floating Ducks; 21, Painted Porcelain Birds for Decoration; 22, Glass Aquarium of Old-Fashioned Shape, Painted in Designs with Bright Colors

166

PAINTED AQUARIUMS AND USEFUL BRIC-A-BRAC

23, Flower Vase in Cubist Design; **24**, Bird Cage on Bamboo Standard Decorated in Gilt; **25**, Aquarium with Metal Support, Festooned with Artificial Flowers; **26**, White Enameled Wicker Basket, Metal Lined, with Decorations of Colored Flowers of Composition; **27**, Colored Wooden Parrot to Balance on Edge of Vase or Shelf; **28**, Metal Doorstop Painted in Bright Colors; **29**, Japanese Flower Basket; **30**, White Enameled Wicker Serving Tray Ornamented with Colored Flowers of Composition; **31**, Bird Sticks with Carved Wooden Birds, for Flowerpots; **32**, Porcelain Flower Holder for Small Bouquets; **33**, Curtain Holders, Rosettes of Artificial Flowers; **34**, Tin Tub and Lattice Painted in Bright Hues, to Hold Potted Vine; **35**, Hanging Flower Box, Metal Lined, Painted in Contrasting Bright Colors; **36**, Enameled Wicker Fern Holder Festooned with Garlands of Composition, Supported by Tall Enameled Standard; **37**, Large, Brightly Hued Porcelain Beetle to be Hung on Wall as Flower Holder; **38**, Miniature Flowerpot; **39**, Garlanded Parrot Cage, Containing Porcelain Parrot, Supported by Metal Standard Decorated to Match Cage; **40**, Small Porcelain Vase with Wax Flowers; **41**, Highly Decorated Japanese Vase with Artificial Cherries; **42**, Painted Flowerpot, Decorated with Old-Fashioned Designs; **43**, Plain Painted Flowerpot; **44**, Fan with Border of Painted Flowers



The Apartment is Reached by Means of an Odd Electric Elevator Which Resembles a Dumb-Waiter

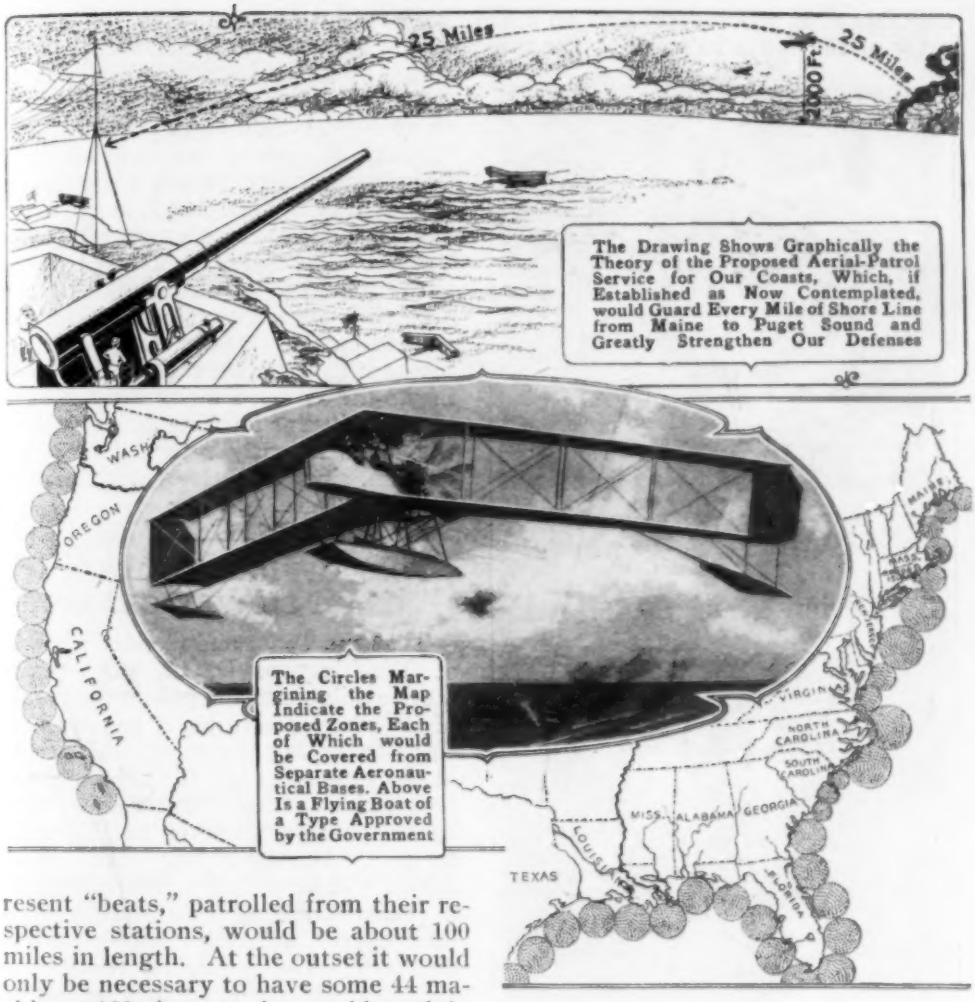
OUTDOOR SLEEPING CHAMBER ELEVATED ABOVE GROUND

At first sight the appearance of an elevated sleeping porch constructed by the city engineer of a small California municipality might reasonably be mistaken for a private water-supply reservoir. The chamber is supported about 40 feet above the ground on an iron framework and is reached by means of a box-like elevator that resembles a large dumb-waiter. This is operated by a small electric motor and enters the room through an opening in the floor. The compartment is sufficiently high to avoid being cut off from the breeze by the surrounding houses, and cool, fresh air is almost always assured. Screens inclose two sides of it, while a substantial roof and canvas curtains provide protection against rains. The supporting structure is made of piping and is braced to withstand severe windstorms. It is erected at the rear of the owner's residence.

FIRST STEP IS UNDERTAKEN FOR AIR COAST PATROL

By employing a comparatively small number of flying boats and creating a series of zones from Maine to Puget Sound, our entire coast could be adequately patrolled and surprise attacks by a hostile fleet thwarted, according to exponents of an aerial-defense plan which is being promoted. The initial move in carrying out this proposed undertaking is now being made on Casco Bay, near Portland, Me., by the establishment of an aerial-patrol base. This station has been promoted by Rear Admiral Robert E. Peary, who urges the coöperation of the various seaboard states of the country in building the complete system of bases advocated.

The financing of the plan would devolve upon the several communities affected. Following its establishment, each unit would be turned over to the naval militia of its state, the officers of which would direct the activities of the airmen. The zones, which would rep-


25 Miles
25 Miles
Ft. 6000
The Drawing Shows Graphically the Theory of the Proposed Aerial-Patrol Service for Our Coasts, Which, if Established as Now Contemplated, would Guard Every Mile of Shore Line from Maine to Puget Sound and Greatly Strengthen Our Defenses
WASH.
OREGON
CALIFORNIA
The Circles Margining the Map Indicate the Proposed Zones, Each of Which would be Covered from Separate Aeronautical Bases. Above Is a Flying Boat of a Type Approved by the Government
MAINE
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISS.
LOUISIANA
TEXAS
FLORIDA

resent "beats," patrolled from their respective stations, would be about 100 miles in length. At the outset it would only be necessary to have some 44 machines; 132 airmen, who would work in three shifts; radio installations, and about 40 telegraphers. The cost would be approximately $400,000.

A number of times each day, in an event of war, an airman carrying an observer would make the flight over his course, driving far enough from land to be able to see enemy war vessels 50 miles or more off the coast. Each flying boat would be equipped with wireless and the scouts kept in constant communication with the shore.

This plan has received very strong backing. Providing interest is manifested by the coast states, it is thought that it can be worked out so as to be of inestimable service to the country. Eventually each station would have an extra flying boat in reserve and the whole system be strengthened.

LARGE SIGN USED BY BOY SCOUTS IN CAMPAIGN

At their headquarters overlooking City Hall Park at New York, boy scouts recently employed a large sign to advertise a vigorous campaign to raise $200,000 during a four-day period. In the middle of the large board, which was more than 50 feet in height, was a picture of a boy in the uniform of a scout. This was provided with a

movable arm which served as an indicator of the funds in hand as the subscriptions grew. When the arm was pointed at the $200,000 mark it was in a saluting position.

COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

Sign Used by Boy Scouts during New York Campaign to Raise Funds for Extending Their Activities

CHUGACH NATIONAL FOREST REDUCED ONE-HALF

The area of the Chugach National Forest, Alaska, which the new government railway will traverse, has been reduced to almost one-half its former size by a proclamation by President Wilson, which has returned to the public domain more than 5,800,000 acres. This is said to be the largest elimination of national-forest land ever made by a single presidential proclamation. The forest as now constituted contains approximately 5,818,000 acres supporting some eight billion feet of merchantable timber. In the area which has recently been excluded there are large quantities of timber also, but it is so sparse and scattered that its commercial value is small. The restricted Chugach forest is the region in which the Alaskan Engineering Commission has been authorized to cut 85,000,000 ft. of timber for the new government railroad. According to the Forest Service there is small opportunity for locating homesteads in the lands recently returned to public domain, since so little of it is available for agriculture.

POST OFFICES TO DISPLAY COAST-SURVEY CHARTS

That the Coast and Geodetic Survey at Washington, D. C., may render more available to the public the results of its many activities, it has been decided to display charts of local interest in the post offices of the principal seaport cities on the Atlantic and Pacific coasts, and in some cities in the interior. Accompanying the chart, which will be suitably framed, will be a placard bearing information as to how charts and publications may be obtained. The published results obtained by the survey include sailing charts; general charts of the coasts; tide tables issued annually in advance showing the time and height of the tide at all principal ports in the United States and at some foreign ports; notices to mariners, issued weekly; special publications on geodesy, terrestrial magnetism, and other subjects pertaining to the work of the survey.

¶What is said to be a record in radio transmission was made a few weeks ago when a wireless operator in Honolulu picked up war dispatches being transmitted from Nauen, Prussia, to Tuckerton, N. J., a distance of approximately 9,000 miles.

To Reproduce the Visual Sensations of a Person Skiing, a Photographer Took Motion Pictures While Coasting on This Bobsled

BOBSLED USED IN TAKING MOTION PICTURES

The problem of how to reproduce vividly and accurately for motion pictures the sensations of a person coasting swiftly down a hillside on skis was solved recently by a Michigan photographer who placed his camera at the rear of a long bodsled such as is used for coasting. Kneeling on the sled behind the camera, while an assistant steered the rapidly moving vehicle down the course, the operator turned the crank of his camera, which was pointed straight ahead. The pictures secured in this way graphically reproduced all the sensations experienced by a person coasting on skis. A few feet after the ski "jump" was reached the sled was swerved to one side and the camera shut off.

¶In six weeks the National Guard of Hawaii increased from 700 to 3,693, exclusive of the naval militia.

GOLD IS MINED FROM RIVER BOTTOM BY DIVER

Gold is being mined from the American River, near Colfax, Cal., in a very curious manner. At the point where the operations are being carried out the bottom of the stream is rich in mineral. This has been carried down by the

Diver Who is Mining Gold from the Bottom of the American River in California

current for years from large hydraulic mines situated some distance above. It is now being removed by a diver who digs the sand and places it in buckets which are drawn to the surface and emptied into sluice boxes. The process is obviously a tedious and somewhat difficult one, but it is netting a good revenue to the miners. The worker who digs the sand from the river bottom wears an ordinary diving costume when working in deep water. He is supplied with air by a pump improvised from two motorcycle cylinders and mounted on a raft so that it is easily moved from point to point.

SQUEEGEE FOOT MAT MADE FOR MOTOR RUNBOARD

To prevent mud, snow, and water from being tracked into a motor car, and also to provide a safe foothold for

Besides Cleaning the Soles of the Shoes, the Mat Provides an Excellent Foothold Which Lessens the Danger of a Person Slipping When Stepping on the Runboard

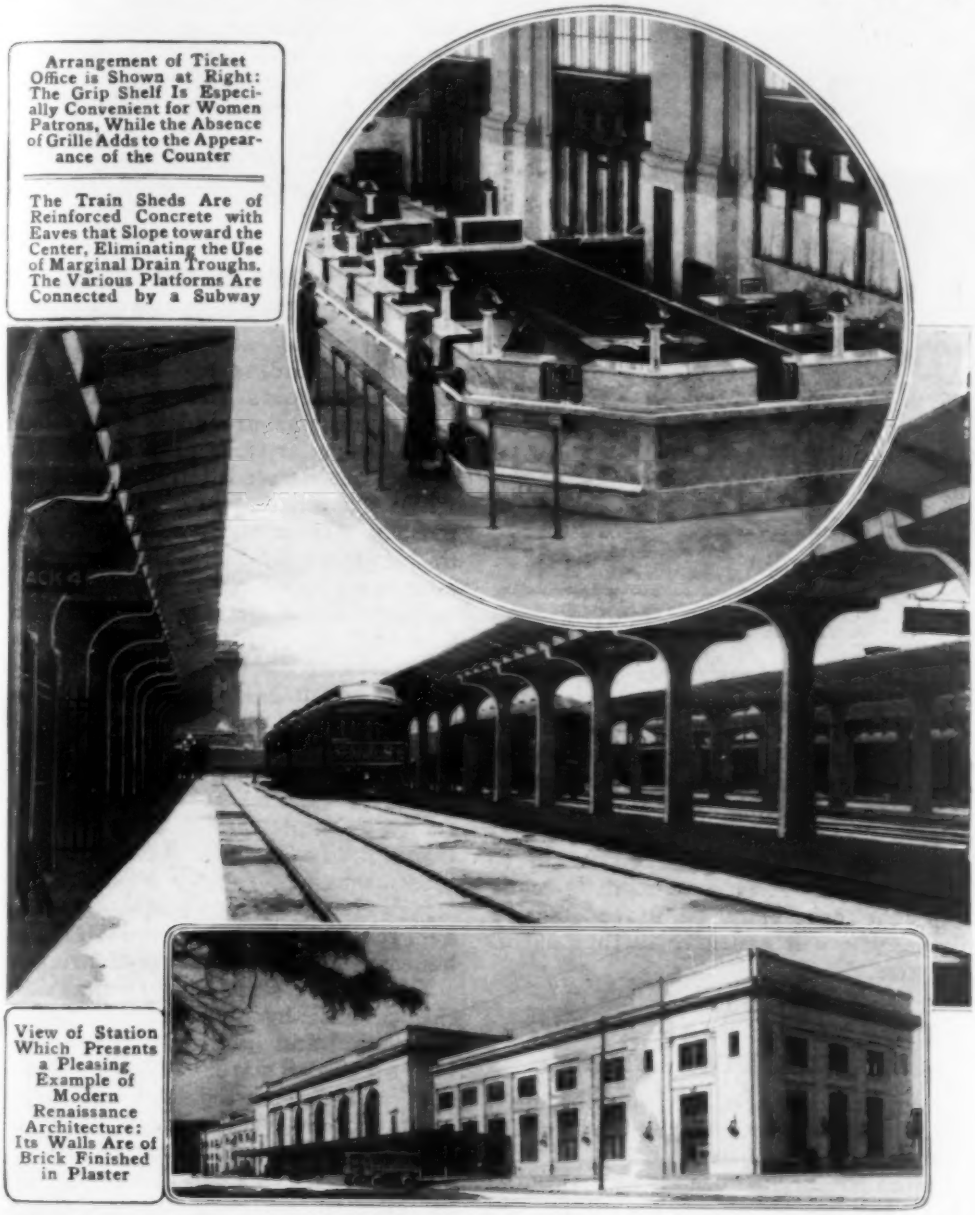
those entering and leaving it, a serviceable mat has been introduced which is intended to be secured to the runboard of a machine. It consists of an enameled metal plate having a series of long slits through which strips of rubber protrude for about an eighth of an inch. These are semipliable and, when the sole of a shoe is scraped across them, act similarly to squeegees, removing water and slush. The device is 1 ft. in length, 8½ in. wide, and extends ⅜ in. above the surface of the runboard to which it is screwed. It is neatly finished, is durable, and lessens the danger of a person slipping when stepping from a car during disagreeable weather. When it becomes necessary to do so, the rubber strips may be replaced by new ones.

NEW LOS ANGELES RAILWAY STATION IS ATTRACTIVE

Several interesting features, intended to be of comfort to patrons and to facilitate the handling of heavy traffic, have been developed in designing a new passenger station on the Southern Pacific Railway at Los Angeles. The building itself, which is an example of modern Renaissance architecture and is finished in plaster over brick, is a large, light, airy, and attractive structure. In the ticket office there is an absence of grille. The counter is designed for free business intercourse and in this respect represents somewhat of a departure from the established plan. The ticket cases are not in evidence, for instead of being kept in plain sight, the coupon racks are in drawers beneath the counter. A grip shelf extends in front of the ticket windows, permitting bags to be rested at a convenient height without cluttering the floor. The check-room and baggage-room counters are likewise low, so that bundles and grips may be passed across them at a normal carrying height.

Another attractive point of the station arrangement is found in the reinforced-concrete train sheds which have been erected. These are of the butterfly type. They were built according to the unit system; the posts and two longitudinal roof sections of each 20-ft.

panel being poured and seasoned some distance from the place of their erection. The canopies dip to the center and at alternate pillars are provided with drain pipes. This plan eliminates the necessity of erecting several thousand feet of troughs along the eaves and thus lessens the maintenance charge. The sheds are quite plain, very neat, and substantial. A 35-ft. space between the station and the first track is covered by a cantilever marquise which forms a sheltered baggage way. Extending beneath the platforms separating the various tracks is a passenger subway. This is 32 ft. in width and divided into two passages, one each for incoming and outgoing traffic.



Arrangement of Ticket Office is Shown at Right: The Grip Shelf Is Especially Convenient for Women Patrons, While the Absence of Grille Adds to the Appearance of the Counter

The Train Sheds Are of Reinforced Concrete with Eaves that Slope toward the Center, Eliminating the Use of Marginal Drain Troughs. The Various Platforms Are Connected by a Subway

View of Station Which Presents a Pleasing Example of Modern Renaissance Architecture: Its Walls Are of Brick Finished in Plaster

RULE CASE IS AID IN MAKE-UP WORK

A contrivance lately out is designed to aid in the make-up of a newspaper, or to help in most any sort of job-printing work. It consists of a case for holding different sizes of column rules, and is arranged to clamp onto the end of the chase. This latter being the metal frame in which the columns of type are put during make-up processes, the presence of the rule case so conveniently at hand is a great aid to rapid work. After one form is made up, the case may be moved to the next, where it can give further useful service.

Rule Case Clamps onto End of Chase, Conveniently at Hand during Make-Up Work

DAM HOLDS WATER UNTIL WARMED FOR BATHING

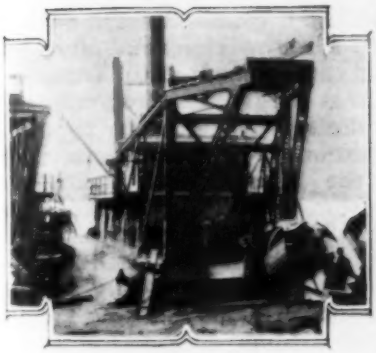
Warm salt water for beach bathing, such as is seldom enjoyed by dwellers along the northwest coast of the United States, has been made available for campers on Puget Sound by the construction of a dam at the mouth of a lagoon which projects into one of the islands in the sound. This dam is of cement and has cement floodgates operated by ordinary windlasses. At high tide the gates are closed, thus enabling a large quantity of water to be held for several hours while the sun warms it. When desired, the water can be changed. If the sun is shining when the lagoon is emptied, the bed of the lagoon soon warms and aids materially in raising the temperature of the new volume of water let in by the rising tide. The lagoon is not over five feet deep except near the floodgates. The cost of this improvement was comparatively small.

RECOVERING SHIPS BEACHED DURING GULF STORM

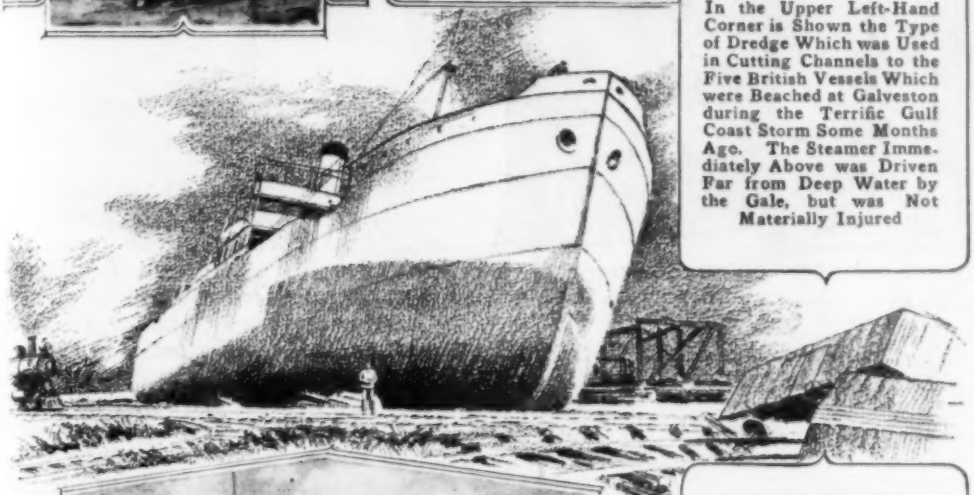
During the severe storm which swept the Gulf coast last fall, four British steamers and a schooner in Galveston Harbor and Bolivar Roads were swept far from deep water. Two of the vessels were left high and dry, while two others were carried nearly five miles from water sufficiently deep to float them. None of the ships, however, was badly injured.

The task of getting the merchantmen back to deep water was the largest salvaging operation ever attempted in the South. To accomplish it five dredges and some 300 men were employed day and night for a period of six weeks. In recovering two of the vessels a channel 4½ miles long, 200 ft. wide, and 15 ft. deep was cut through the bay. In each instance it was necessary to cut a slip to the stranded vessel, dig entirely around it and then remove the sand and earth beneath it by hydraulic pressure.

One of the ships was carried down the channel by the hundred-mile-an-hour wind and lifted out of the water into a railroad yard. A large steamer and a three-masted schooner were grounded on Pelican Spit, while the other two ships were carried out into a prairie at Swan Lake. The machinery in the four steamers was capable of being operated, so when it came time to make the final efforts to float the vessels, basins were dredged under their propellers and power from their own engines used to assist the tugs.

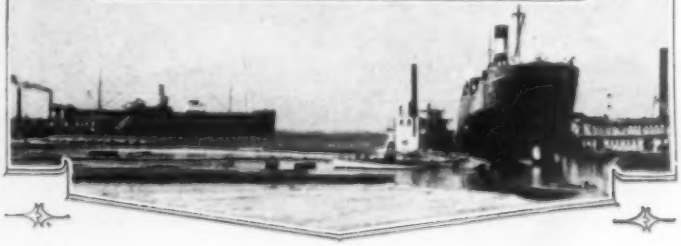


In the Upper Left-Hand Corner is Shown the Type of Dredge Which was Used in Cutting Channels to the Five British Vessels Which were Beached at Galveston during the Terrific Gulf Coast Storm Some Months Ago. The Steamer Immediately Above was Driven Far from Deep Water by the Gale, but was Not Materially Injured



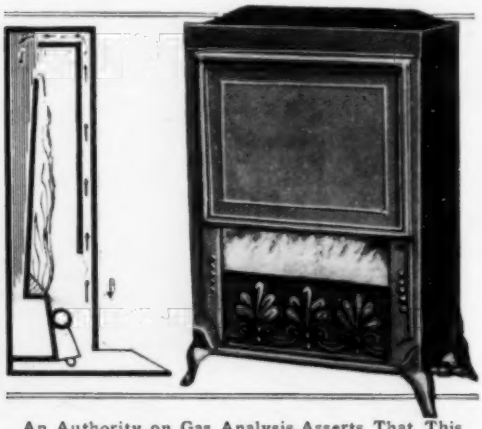
The Artist's Sketch Above Pictures Another of the Merchant Vessels Caught by the Storm: This One was Swept Down a Channel and Lifted Bodily into a Railway Yard, Where It Rested across the Tracks and on a Turntable until Salvaged. At the Left are a Schooner and Steamer Which were Driven from Deep Water and Left High and Dry

By an Odd Coincidence the Two Vessels Below at the Right Stayed Together during Their Wanderings and were Finally Grounded in a Prairie at Swan Lake, Several Miles from Water of Any Depth. This Photograph was Taken When the Dredging Operations Were at Their Height. The Picture Above Shows a Dredge Cutting a Channel around One of the Boats



NO OUTLET FOR GAS FUMES NEEDED WITH NEW STOVE

Intended particularly for installation in rooms not provided with chimneys, a gas heater has been designed which

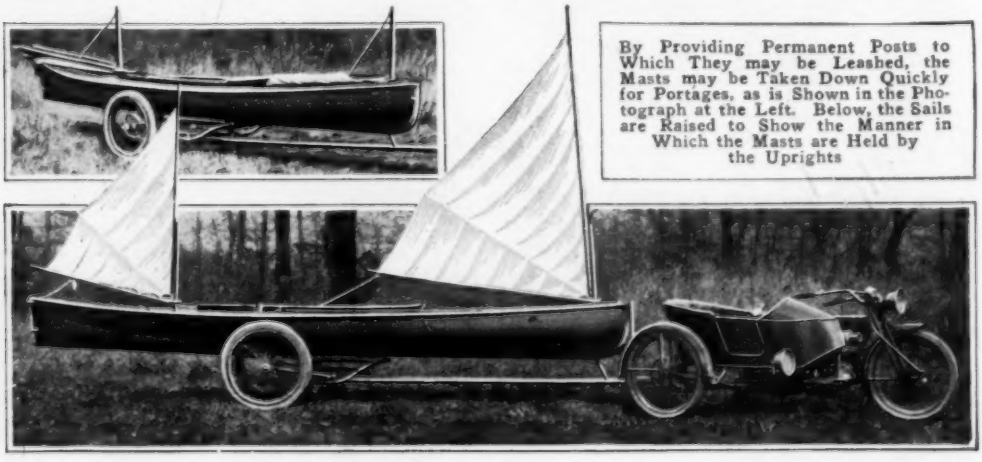


An Authority on Gas Analysis Asserts That This Stove Produces Complete Combustion

is claimed to insure complete combustion of the fuel it uses. In outward appearance it is quite like many similar stoves used in the natural-gas belts. Its internal construction, however, differs considerably from that of the ordinary stove of this type. Furthermore, it has no outlet for fumes. It is provided with a series of deflecting plates forming channels in which the gas is burned and through which superheated air is circulated. The arrangement is such that the heated air produces a suction that draws the products of combustion —or unburned gases—upward with it and into a return channel. Here the products are mixed with fresh air drawn in at the front of the stove, carried to the top through a passage and forced around into the return duct. Finally the gases are driven across the burner from the back of the stove and reheated. This cycle continues as long as the stove is burning. Tests recently made by an eastern authority showed that no carbon monoxide was present after combustion.

FOLDING MASTS USED ON TRAILER BOAT

To permit the masts of a small sailing boat to be folded back out of the way, an Illinois sportsman, who frequently transports his craft on a motorcycle trailer, has secured a short substantial post aft of the cockpit and at the bow. When erected, each mast is leashed at the top of one of these permanent uprights and held in place at the bottom by a fork which is fastened to one end of the boom. It is a matter of but a moment's time to raise them for sailing, and when they are lowered, cross-country runs may be made easily and without danger of the masts striking the lower limbs of trees or other overhead obstructions which might snap them off. The arrangement also permits the craft to be used for paddling without serious inconvenience.



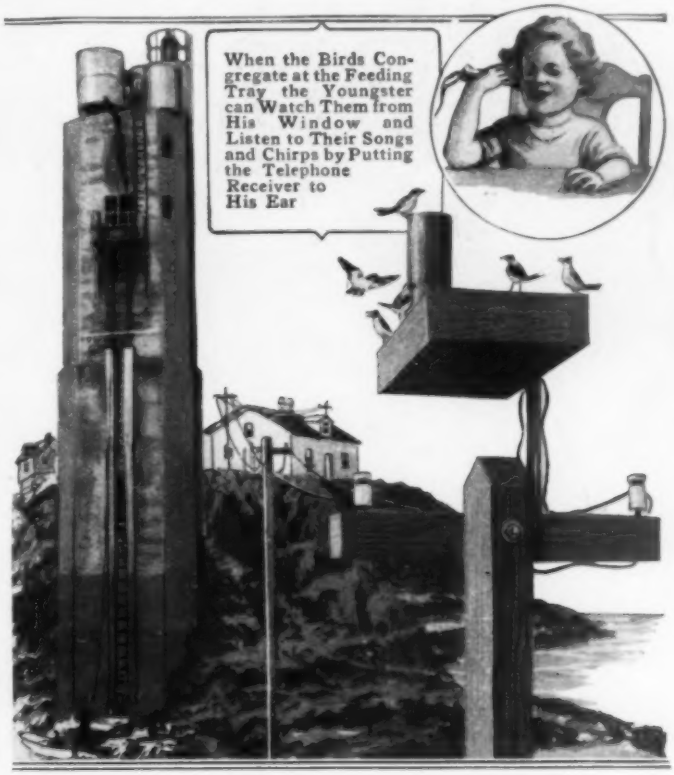
By Providing Permanent Posts to Which They may be Leashed, the Masts may be Taken Down Quickly for Portages, as is Shown in the Photograph at the Left. Below, the Sails are Raised to Show the Manner in Which the Masts are Held by the Uprights

ENGINEERS ERECT BRIDGE WITHIN TUNNEL

Engineering problems in ordinary tunnel construction are many and difficult enough, but in the recent building of a subway in Berlin a new proposition was encountered. Deep underground two unexpected beds of peat halted progress, it being obvious that the material was too spongy to support the weight of the tunnel structure, let alone that of passing trains. To get over the obstruction the novel idea of building two steel bridges within the narrow confines of the tunnel was proposed and carried out. One of the structures so built had a span about 200 feet long and the other nearly 140 feet, the first time probably that bridges of such length were ever erected underground. It would have been simpler, perhaps, to have sunk concrete piles in the peat and erected the tunnel upon these as a foundation, but the idea was rejected because of the probability that acids in the peat would attack and seriously injure concrete supports in the course of time.

TELEPHONE CARRIES SONGS OF BIRDS INTO HOME

Quite an interesting as well as ingenious use is being made of a telephone by the keeper of a lighthouse on the Island of Guernsey, off the coast of France, for the entertainment of his four-year-old son. The boy is fond of birds, but the presence of a cat in his home keeps them on their guard and restrains them from venturing near. This difficulty has been overcome to an extent by erecting a feeding tray at the top of a pole some distance from the dwelling. There the birds congregate and chatter away without fear. A telephone transmitter, sheltered from rain and snow by an inverted cocoa can, is mounted on the platform, while wires connect it with a receiver installed in the near-by house. By standing at a window the youngster can watch the robins, finches, and other birds feeding, and at the same time listen to their chirps and songs. The novel system has been in use for a number of months, has worked admirably well, and has been the means of affording the boy an almost endless round of pleasure day after day.


When the Birds Congregate at the Feeding Tray the Youngster can Watch Them from His Window and Listen to Their Songs and Chirps by Putting the Telephone Receiver to His Ear

---

¶Fire caused by the friction of a rear wheel of the wagon against a piece of misplaced board resulted in the loss of a load of hay that was being driven to market by a Pennsylvania farmer.

TIN KITCHEN UTENSILS FORM NOVEL BOUQUET

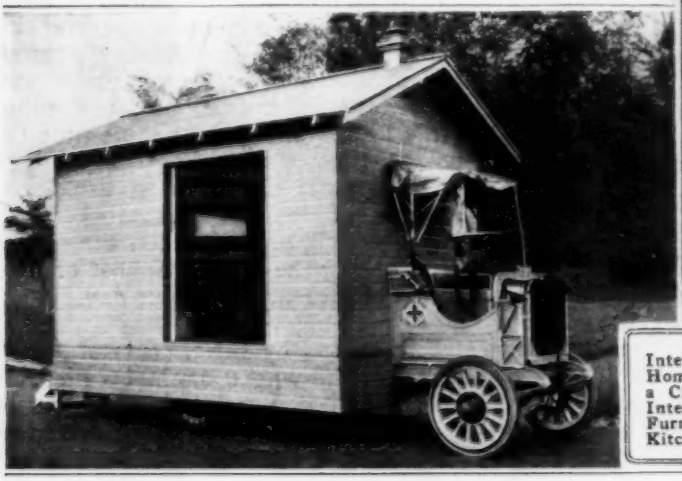
Among the many remembrances received by a wealthy New York woman on the occasion of her tenth wedding anniversary, which was recently celebrated at one of the downtown hotels, was a tin bouquet. It was composed of divers kitchen utensils interspersed with a small amount of greenery and tied with flowing white ribbons. Tea strainers, egg beaters, cake turners, soap baskets, funnels, large spoons and small spoons, with many other things, were represented in the collection. The idea was so well carried out that the assorted bouquet proved to be one of the most-talked-of gifts of the evening.

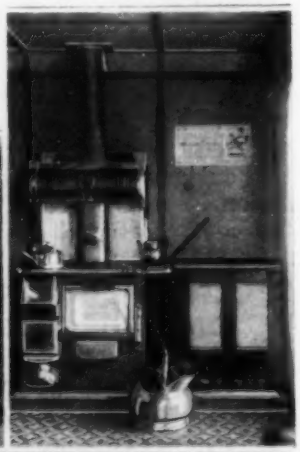
COPYRIGHT, UNDERWOOD & UNDERWOOD

Curious Bouquet Presented to a New York Woman in Honor of Her Tenth Wedding Anniversary

MODEL HOME IS CARRIED ABOUT ON AUTO TRUCK

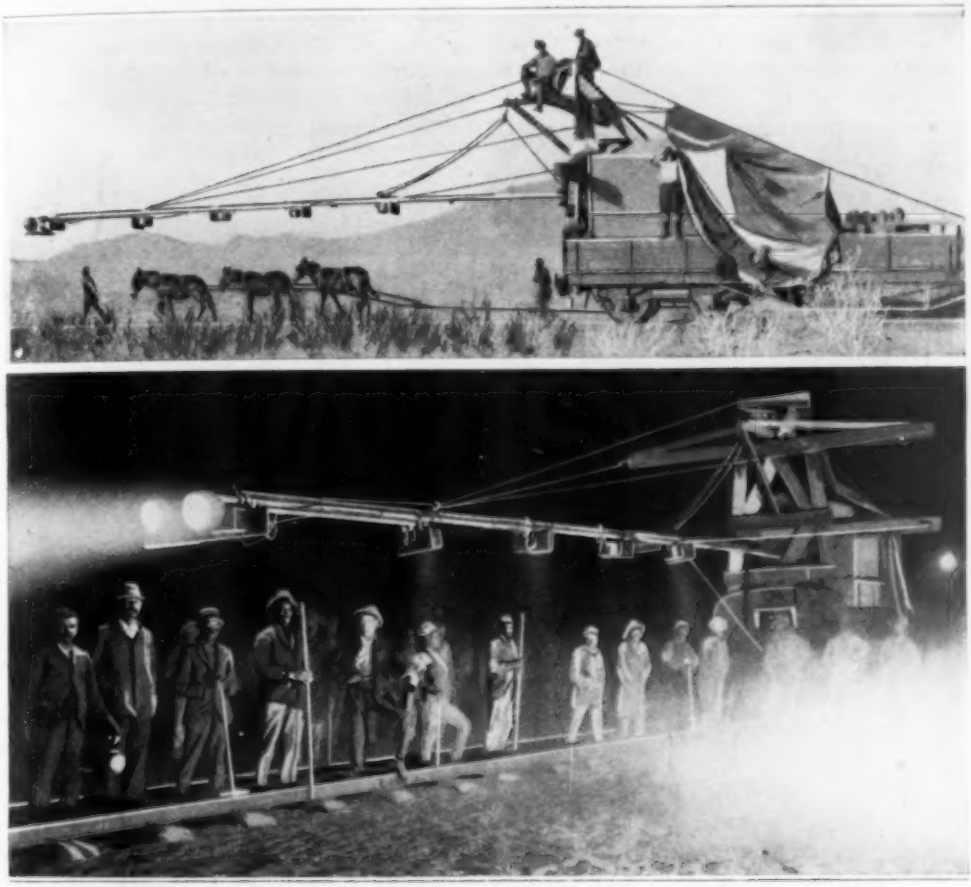
A western compressed-fuel concern recently devised a neat plan for advertising its product. On the broad platform of an auto truck a model house was erected, complete as to detail and well furnished. Across a rear corner a fireplace blazed forth a welcome to visitors, while in the front end, a full-sized kitchen range and full complement of cooking utensils stood ready to cook any sort of luncheon desired. With this novel outfit the streets of the city and vicinity were toured, the odd appearance of the house attracting attention and the conveniences within calling forth favorable comment. Of course the fuel used in fireplace and range was the briquettes made by the company. These consist of a compound of coal dust and asphaltum.





Interior and Exterior of Model Home Carried about the Streets of a City in an Advertising Plan. Interior is Neatly Finished and is Furnished with Tables, Chairs, a Kitchen Range, and a Fireplace

PROJECT TRACK AT NIGHT UNDER ELECTRIC LAMPS



COURTESY RAILWAY REVIEW

This Shows at Close Hand the Arrangement of the Lamps and the Strong Light Cast along the Track by Them

In building a strategical railway in South Africa to connect Prieska, Upington, and Kalkfontein, an interesting system of illumination has been employed to expedite tracklaying at night. A 50-ft. boom, made of 2-in. pipe fastened to a plank, was extended from a trestle erected at one end of an open work car. This was supported by a cable attached 10 ft. aft of the forward end and passed over the top of the trestle to the rear of the car where it was secured to a winch. Five 100-cp. incandescent lamps mounted in reflectors were arranged, face down, along the under side of the boom at intervals of about 10 ft., while at the extreme end of the cantilever a pair of similar lamps were placed horizontally so as to throw a strong light for a distance of about 120 ft. ahead. The light was diffused along the track beneath the boom and in advance of it so that workmen could lay rails, tighten joints, and do all other work without difficulty. Power for these lamps, and for portable ones used along the sides of the material train when unloading was to be done, was supplied by a dynamo driven by a 5-hp. oil engine. With this arrangement it was possible to carry the work on at night without interruption, which was considered at the time to be highly necessary.

AEROPLANE IS FEATURE OF LORD MAYOR'S PARADE

A feature of an enormous parade held recently at the inauguration of the newly elected lord mayor of London was an aeroplane attached to the rear of an automobile and pulled through the streets as one of the spectacular floats. The use of a flying machine in such connection was unusual, especially in such an old-time pageant as the lord mayor's parade. The first of such affairs was held in 1215 and grew out of a requirement in a charter granted by King John that the citizen chosen to be mayor should be presented to the king or his justice for approval. The mayor rides in an elaborate coach in such parades.

Aeroplane Hauled through Streets of London as One of the Spectacular Floats in Lord Mayor's Parade: Pageant Is Outgrowth of Old-Time Custom of Honoring Newly Elected Mayor While En Route to Inauguration. The First Such Parade was Held in 1215

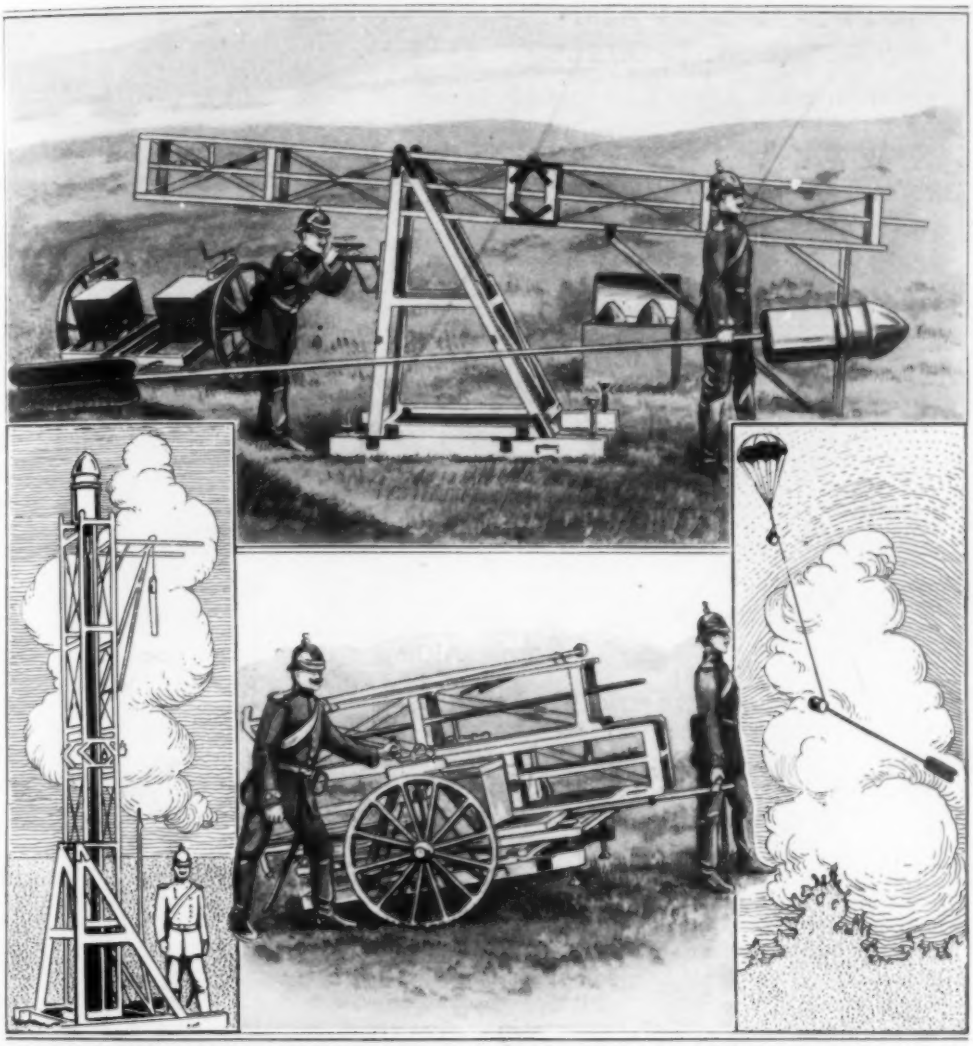
COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

NEW YORK NATIONAL GUARD GIVEN ARMORED TRAIN

An armored train and an armored aeroplane soon will be added to the equipment of the New York National Guard through the generosity of certain public-spirited citizens. The governor of the state has approved of a request for a $10,000 appropriation to be used in maintaining the train; a similar amount is asked for the aeroplane. It is said that this will be the first armored train in this country. One of its units will be a battle car carrying nine or ten men and resting on especially constructed trucks equipped with motor apparatus and steering gear at either end so that it can be run in either direction without reversing control. There will be seven lightly armored fast motor cars for carrying machine guns and suitable for scout work or bringing up ammunition. Twelve motorcycles also will be equipped with machine guns. The train, if bought in the open market, would cost approximately $150,000. It will need the services of fully 100 men. The armored air craft is the gift of several prominent citizens who are especially interested in military aviation.

WAGON CARRIES SKYROCKET PICTURE-TAKING MACHINE

Skyrocket photographing outfits have been considerably developed by the Germans for taking pictures of enemy country, a similar device having been described in this magazine a few



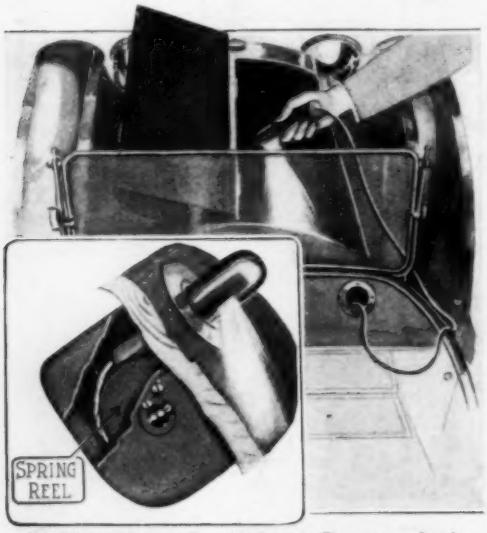
Apparatus for Taking Pictures of Enemy Country with a Camera Carried on a Skyrocket: The Equipment may be Packed Compactly on a Wagon and Easily Transported

years ago. A new outfit was recently brought out, the various parts of which fold compactly, allowing easy transport in the field.

The rocket used is about 19½ ft. long, and carries a camera in the conical nose, and a parachute in the cylindrical part. A tall tower is provided for guiding it at starting. The structure which serves in this connection is made in two sections, and forms the bulkiest part of the apparatus. Interlocking joints hold it together when erected, and near the middle an A-shaped support is provided. In shooting a rocket, the missile is placed within the tower, the latter rotated to an upright position, and the powder charge touched off. The long projectile mounts high in the air, a gyroscope in its upper end keeping the camera pointed in the right direction, until a picture is taken. Coming down, the parachute unfolds from the upper barrel and conveys the various pieces safely to the ground. Afterward the film is taken from the camera and developed.

DASHBOARD LAMP ASSISTS IN LOCATING TROUBLE

An electric dashboard lamp recently put on the market is intended for use in locating troubles around an auto-



Dashboard Lamp Provided with Extension Cord: Automatic Reel Takes Up Surplus Length

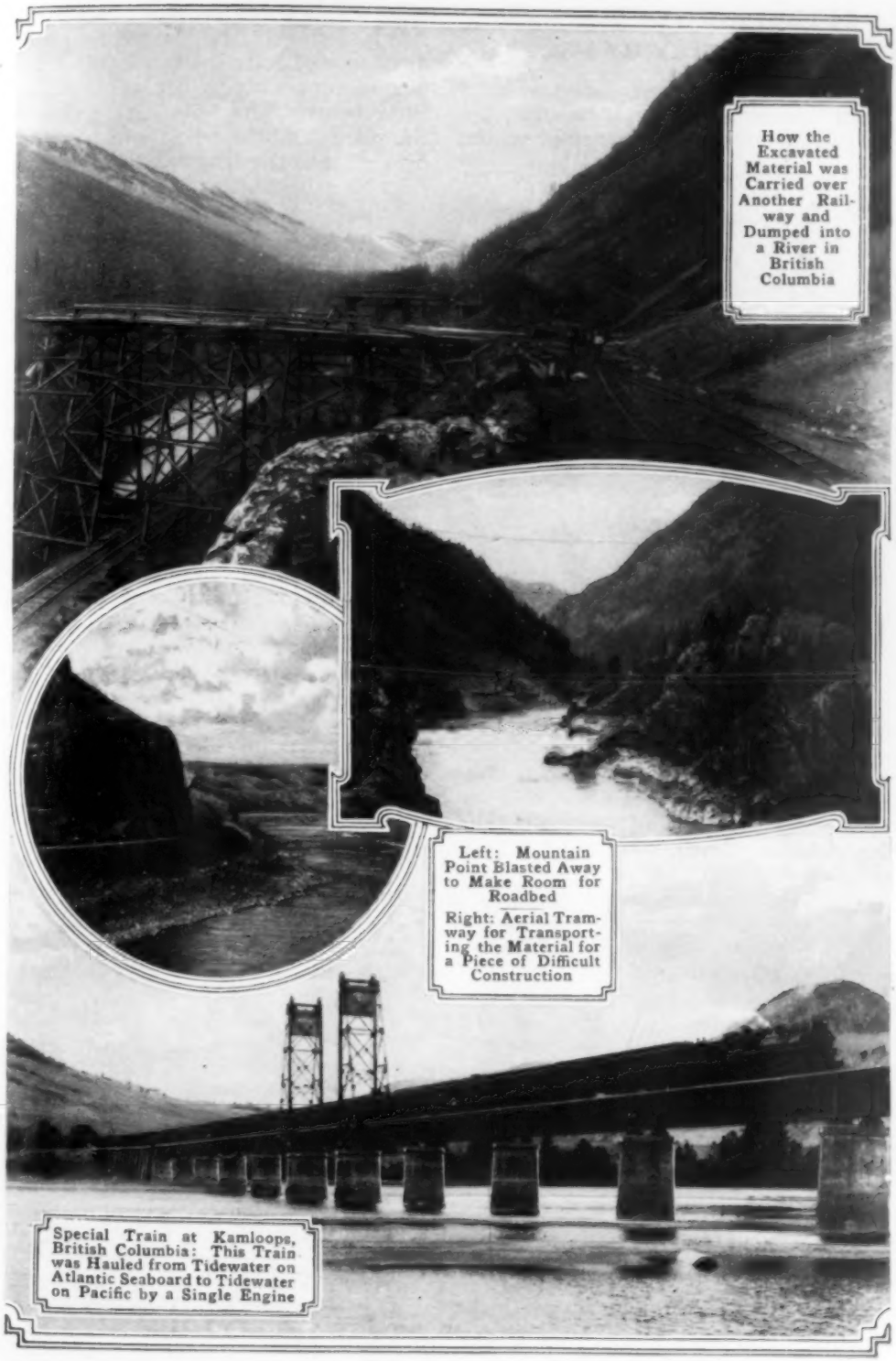
mobile at times when darkness would make the finding difficult. An interesting feature about the device is its especial convenience. The trouble lamp is fastened to the end of a long lamp cord. Back of the dashboard an automatic reel takes up all of this cord except the part necessary to reach a given locality, thus making it unnecessary to coil up the wire by hand every time the device is used. When not in use as a trouble hunter, the lamp and its holder fit into a socket on the dashboard next to the reel. A metal cap fitting down over the end of the light converts it into the ordinary dashboard type.

WHALE-OIL PRODUCTION INCREASED BY WAR

The fact that large quantities of whale oil are used in the composition of glycerin, thus making it a factor in the manufacture of high explosives used in such vast quantities in the war, is regarded as one of the reasons for the increasing volume of the whale-oil business. In 1914 the world's production amounted to 750,000 bbl. The uses of whale oil are more numerous at the present time than ever before. Among the many ways in which it is employed are: In treating leather; in the iron and steel industries for hardening processes; for lubricating, often mixed with mineral oils; in the manufacture of artificial rubber, and in the soap industry.

OPENING OF NEW RAILWAY LINE ACROSS CANADA

The running of a special train over the Canadian Northern Railway from tidewater on the Atlantic seaboard to tidewater on the Pacific marked the completion of a railway project that is in many ways one of the most interesting pieces of railway construction ever carried out on the American continent. Although this line traverses hundreds of miles of country that is exceedingly difficult for railway construction, the grade at no point exceeds .6 ft. in 100 ft. Every curve is "compensated," this being a term used by railway engineers to indicate that on curves the grade is reduced sufficiently to make the total resistance that an up-bound train has to meet just equal to that caused by the full grade on straight track. Because of this low grade it was possible to haul the special train, carrying 150 passengers and made up of 15 of the heaviest standard passenger cars, from Quebec to Vancouver with a single engine. An idea of the kind of country through which the line was built is given in the accompanying illustrations. Fully as remarkable as the construction of the road was that of financing it. A large percentage of the line is made up of short railroads that were bought and connected to make a continuous line. This, as well as the new construction, was financed by means of bonds which in every case were guaranteed either by the Dominion government or by the individual provinces through which the line passes.



How the Excavated Material was Carried over Another Railway and Dumped into a River in British Columbia

Left: Mountain Point Blasted Away to Make Room for Roadbed

Right: Aerial Tramway for Transporting the Material for a Piece of Difficult Construction

Special Train at Kamloops, British Columbia: This Train was Hauled from Tidewater on Atlantic Seaboard to Tidewater on Pacific by a Single Engine

PROTECTING YOUNG PLANTS FROM INJURY BY FROST

For shielding delicate young plants from spring frosts and freshets, ingenious covers are being used in the

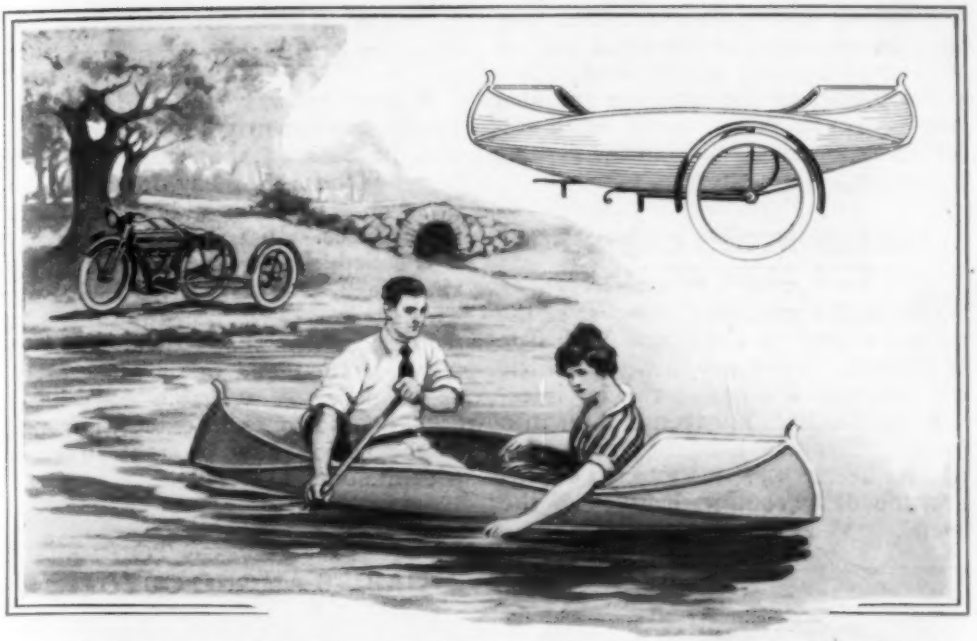
In One Section of Southwestern California Thousands of Acres of Plants are Covered by Using a Hand Implement to Set Cone-Shaped Shields in Place

fields of southwestern California by truck gardeners, and others. The individual covers are pressed into shape from blank disks made of a light, flexible material which is waterproof. The operation of setting them in place is a simple procedure which requires but little labor. They are first laid over the plants and their bottom edges then pressed into the loose earth, by means of a hand implement, and held securely. Two men working together, it is said, can distribute and anchor several thousand in a day's time. Since they are made of an opalescent material, they care for the young plants nearly as well in mild weather as if the plants were set in greenhouses. By employing them, growth is hastened, losses guarded against, and the chances for early crops increased.

MOHAIR OF UNUSUAL LENGTH SHEARED FROM GOAT

Certain breeds of Angora goats furnish a very long and silky grade of mohair which is extensively used for different commercial purposes. Before being sheared, as is shown in the accompanying illustration, the fleece of these animals is combed and carefully braided. In this instance the mohair is of a remarkable length and even in its heavy braids sweeps the ground. The fleece yielded at this clipping weighed approximately 30 pounds.

The Pile of Wool Shown in the Middle was All Taken from the Goat Shown While being Sheared at the Right



The Body of the Sidecar Forms a Very Comfortable Canoe, Serviceable for Both Hunting and Pleasure Purposes

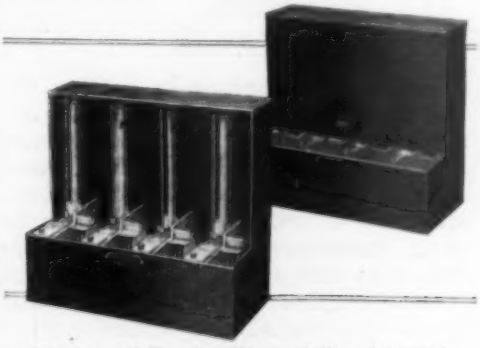
NEW SIDECAR IS ADAPTED FOR LAND AND WATER

While some of the latest amphibious motor cars are attracting considerable attention both here and abroad, a British company has developed a land-and-water sidecar attachment for the motorcycle which is also a curious innovation. The body of this is built along the same lines as a canoe, is secured to a very low chassis by means of four winged nuts, and may be quickly detached and used in the water. The framework is constructed of wood and provided with metal shields at each end, while the exterior is covered with stanch, waterproof canvas. It has sufficient room for two persons and when used as a canoe may be paddled with ease. While it is particularly convenient for the cyclist who uses his machine on shooting trips, it is equally well adapted for pleasure purposes.

¶Invar metal, which has a very low coefficient of expansion, is now being manufactured in the United States.

MACHINE IS AUTOMATIC RECEIVING TELLER

A contrivance which automatically receives, registers, and receipts for coins deposited is now being manufactured and sold as a supplement to the regular savings service offered by banks. It is intended that the machines shall be placed in schools, fac-



Interior and Exterior Views of New Automatic Savings Bank

tories, hotels, department stores, and the like, to pick up spare change a passer-by might want to save. Stamps are issued as receipts, and when

amounting to a dollar, or more, they may be deposited in the usual way as a savings account in the bank. The coins placed in the machine are filed compactly in metal tubes until collected by an emissary from the savings institution.

TRAINED NURSE CARES FOR CUB LION AT ZOO

One of the youngest members of the animal colony at the Grant Park Zoo in Atlanta is a tousy, awkward little cub lion which dines at regular intervals on warm milk given to him in a bottle. His meal hours are events which break the monotony of his keeper's daily routine, because of the

Feeding the Cub Lion to the Wonderment of His Small Playmate, the Fox Terrier

eagerness he displays in getting the last drop from the vial. The cub has several distinctions, one of them being that he is attended by a trained nurse who is especially employed to look after his wants. As a companion he has a fox-terrier pup, as lively as himself, that helps him while away the hours. Neither of the animals seems to hold any prejudice against the other and they play almost as contentedly as if they were of the same family. At feeding times, however, the dog manifests much curiosity at the nursing, which he apparently cannot understand.

NEW SIBERIAN RAILWAY TAPS RICH REGION

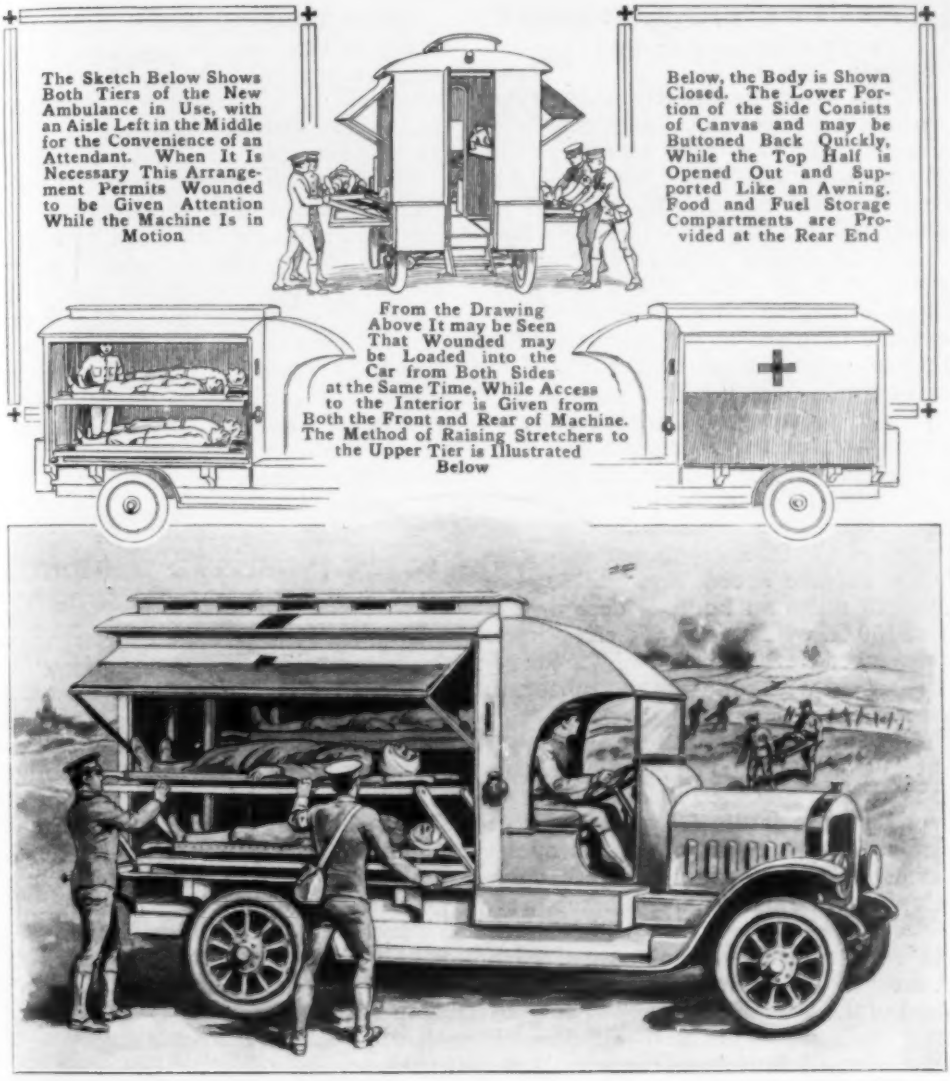
A new railway line, 501 miles in length, has recently been put in operation in Siberia, connecting with the Trans-Siberian Railway. It opens a section rich in minerals and in agricultural possibilities. In this Altai region, as it is called, are deposits of gold, silver, zinc, lead, and copper, which were worked in the eighteenth and nineteenth centuries, but owing to poor transportation and other causes were abandoned. A valuable coal basin, 6,000 square miles in extent, is a part of the region now brought in touch with the outside world.

FOREST SERVICE TO FIGHT RABIES AMONG COYOTES

Because of a very serious outbreak of rabies infection among wild and domestic animals in the West, a special fund has been set aside for use of the Biological Survey and the Forest Service in fighting this dread disease. The malady has been prevalent among coyotes in eastern Oregon and Washington and has spread into California and Nevada. Alarm has been manifested by residents of the infected districts, many of whom feared for the safety of their children on the roads to and from school. Efforts several months ago to eradicate the disease were unsuccessful because they did not cover wide enough areas. With the government funds recently allotted to this work of fighting the disease, additional men will be hired and traps and poison purchased.

NEW MILITARY AMBULANCE IS LOADED QUICKLY

In an attempt to improve the arrangement of military and emergency ambulances so as to facilitate the work of loading and unloading them, a new type of body has been developed which has a number of apparently good points. It is similar to certain Eu-


The Sketch Below Shows Both Tiers of the New Ambulance in Use, with an Aisle Left in the Middle for the Convenience of an Attendant. When It Is Necessary This Arrangement Permits Wounded to be Given Attention While the Machine Is in Motion
Below, the Body is Shown Closed. The Lower Portion of the Side Consists of Canvas and may be Buttoned Back Quickly, While the Top Half is Opened Out and Supported Like an Awning. Food and Fuel Storage Compartments are Provided at the Rear End
From the Drawing Above It may be Seen That Wounded may be Loaded into the Car from Both Sides at the Same Time, While Access to the Interior is Given from Both the Front and Rear of Machine. The Method of Raising Stretchers to the Upper Tier is Illustrated Below

ropean ambulances in that access to the interior is given at either side of the car. It is designed with two decks. The upper of these is built in two sections, each supported on folding arms that enable it to be let down level with the lower tier. In loading, this permits a stretcher to be placed in the upper frame, while the latter is at a convenient height, and then pushed into position with comparative ease. Obviously this is much easier for both the patients and ambulance attendants. Doors are placed fore and aft, permitting an attendant to enter the ambulance compartment from his seat beside the chauffeur while the car is in motion, as well as from the rear at other times. The roof is built similar to that of a street, or railroad, car and is fitted with a series of ventilators. Storage compartments are provided at the rear and also near the front on each side for food, medical and surgical equipment, and an auxiliary supply of fuel. The arrangement permits wounded to be loaded into the ambulance from both sides at once.

NAVY'S LATEST SUBMARINE PUT THROUGH TRIALS

Tests which apparently proved very satisfactory were recently made in Cape Cod Bay, off Provincetown, Mass., with the "M-1," the latest and largest ocean-going submarine so far completed for the United States Navy. The boat has a guaranteed cruising radius of 3,500 miles and is said to be capable of covering a 5,000-mile course without stopping to replenish either its fuel or supply stores. After one of its early trials, during which it spent four hours in a choppy sea, it was declared by its commander to be the best submersible flying the American flag.

The "M-1" represents the first of a new type of craft. It has an over-all length of 185 ft., is capable of maintaining a surface speed of slightly more than 18 miles an hour, is designed to dive 150 ft. with safety, and can remain submerged for a period of 72 hours. It is armed with four torpedo tubes and a deck gun.

The engines are of the Diesel type, but have been developed in this country and modified in an attempt to overcome the faults found in those of similar design used in the European navies. The two engines together develop approximately 900 horsepower, while the electric motors which drive the craft when it is submerged give about 700 horsepower. The arrangement of the boat differs somewhat from the "Holland" boats and embodies a new form of hull construction.

The cruising radius and high surface speed of the "M-1" will enable it to be used more effectively than former models. In this connection the recent tests were watched with particular interest, because the "M-1" closely resembles the fleet submarine "Schley" which is now under construction. The latter craft is of a still more formidable pattern, for when completed it will have a length of about 265 feet, a displacement of approximately 1,000 tons, and will represent an expenditure of nearly $1,350,000. It will have a surface speed of about 23 miles an hour, which will enable it to operate in conjunction with a fleet and possibly even take the place of a torpedo-boat destroyer.

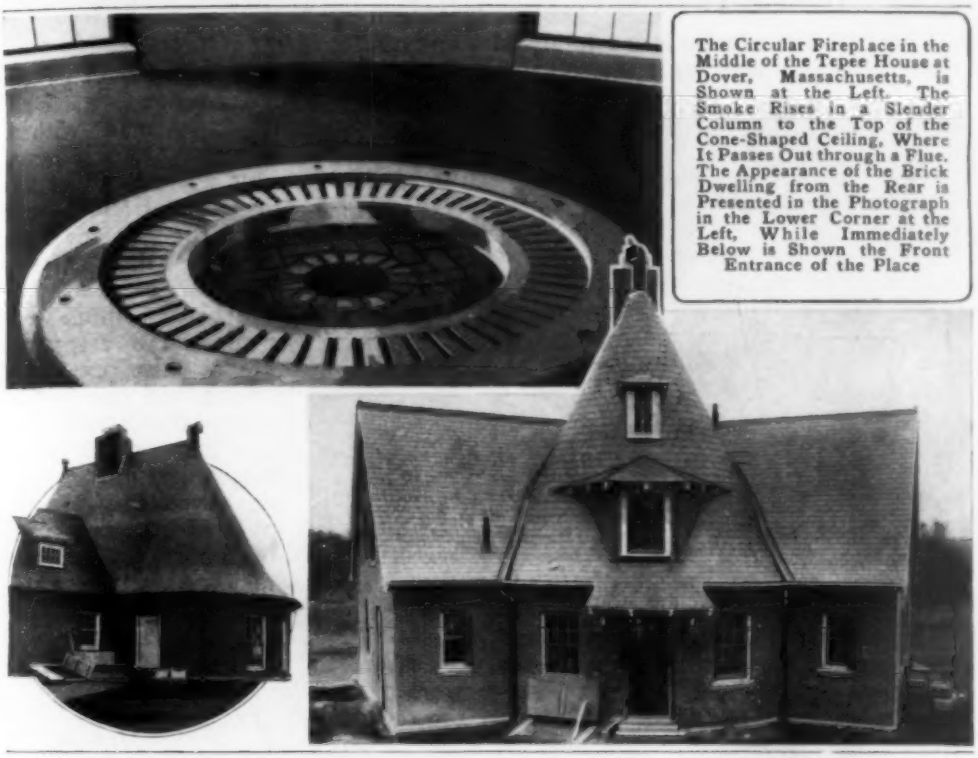
LIGHT-SENSITIVE MINERALS OPEN NEW DOOR TO SCIENCE

The element selenium has long attracted considerable attention because of the peculiar effect light exerts on its electrical conductivity. Scientists have now discovered that copper oxide has properties similar to selenium. Another mineral recently put in the same class is stibnite, an antimony mineral. Other materials, such as sulphur, shellac, paraffin, and anthracene, a coal-tar product, will also exhibit odd conductivity effects under the influence of light, but to a lesser degree. Keen research in this class of substances is being carried on in a great many scientific laboratories throughout the world.

The "M-1" under Way: The Latest and Largest Under-Water Fighter of the United States Navy

It Is Capable of Making a Surface Speed of 18 Miles an Hour and Dives 150 Feet Safely

BRICK DWELLING MODELED AFTER INDIAN WIGWAM



The Circular Fireplace in the Middle of the Tepee House at Dover, Massachusetts, is Shown at the Left. The Smoke Rises in a Slender Column to the Top of the Cone-Shaped Ceiling, Where It Passes Out through a Flue. The Appearance of the Brick Dwelling from the Rear is Presented in the Photograph in the Lower Corner at the Left, While Immediately Below is Shown the Front Entrance of the Place

One of the queerest-looking houses in Massachusetts is a brick residence at Dover, now nearing completion, which architecturally represents a modern adaptation of an Indian tepee. It has been designed according to the rather fantastic ideas of a Bostonian who has embodied in it several odd features.

The central part of the building is conical in shape and flanked on either side by wings which are a story and a half in height. The circular section forms two-thirds of the residence, and the interior consists of one large room, 24 ft. in diameter. In the middle of its red-tile floor is a circular fireplace which might easily be mistaken for the base of a gun turret or a mounting for a heavy turbine. Air forced up from the basement passes through a grating, margining the inner circumference of this, and creates a draft which carries the smoke to the peak of the room, 32 ft. above the floor, where it passes out through a flue. The tapering ceiling is finished in very dark blue to represent the sky. This is bedecked with tiny stars, showing the various constellations as they appear at night on March 18.

The rest of the building is heated electrically. This system is controlled by a master switch in a bedchamber, enabling the rooms to be thoroughly warmed, the kitchen range heated ready to prepare breakfast, and plenty of hot water stored before the occupants arise. When the house is to be left for an indefinite period during cold weather, the closing of the front door directs current to an electric apparatus which keeps the water in all of the pipes lukewarm while the owner is absent, thus preventing the plumbing from being injured by freezing temperatures. The house has attracted much attention because of its architecture.

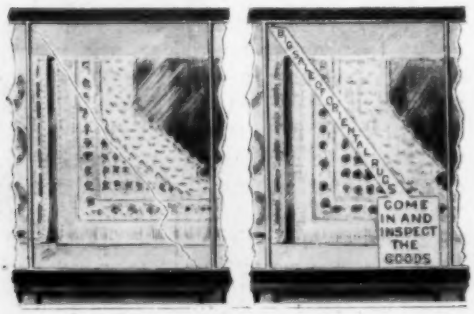
MINE BLAST IS FOLLOWED BY UNEXPECTED RESULTS

Events of unusual nature followed an attempt at blasting in a Kansas mine recently. Electrical means had been employed to fire off a minor charge, or two, when suddenly a reverberating explosion occurred, much greater than that caused by an ordinary small stick of dynamite, and affecting all the main passageways and shafts of the mine. Persons near the mouth were knocked over by the concussion, among them a man with a camera. Quickly jumping up, he seized the instrument and trained it on the sheds over the mine shaft. Almost instantly huge volumes of black smoke appeared, the aftermath of a dust explosion which had caused the unexpected concussion. The man's quick action resulted in his securing an excellent picture, out of the ordinary both in its subject matter and in the quick thinking necessary to secure it. Fortunately no one was killed in the accident. The miners were off for the afternoon, celebrating the recent arrival of pay checks.

Volumes of Smoke and Dust Issue from Shaft When Dust Unexpectedly Explodes in Kansas Mine

MERCHANT COVERS CRACK IN WINDOW WITH SALE SIGN

A large plate-glass window in a Chicago department store was accidentally cracked down its whole length recently. The beauty of displays within the window was seriously marred by the disfigurement, and another window of like size could not at once be obtained. What to do in the matter was something of a puzzle. Finally a solution was reached by planting a long sale sign directly over the crack. Being of stiff material, the sign securely hid the fracture, and made the window appear whole. In this manner interest of a passer-by was centered on the display within rather than on the fractured glass.



Disfiguring Crack in Window Covered with Sale Sign, Thereby Diverting Attention to Display Within

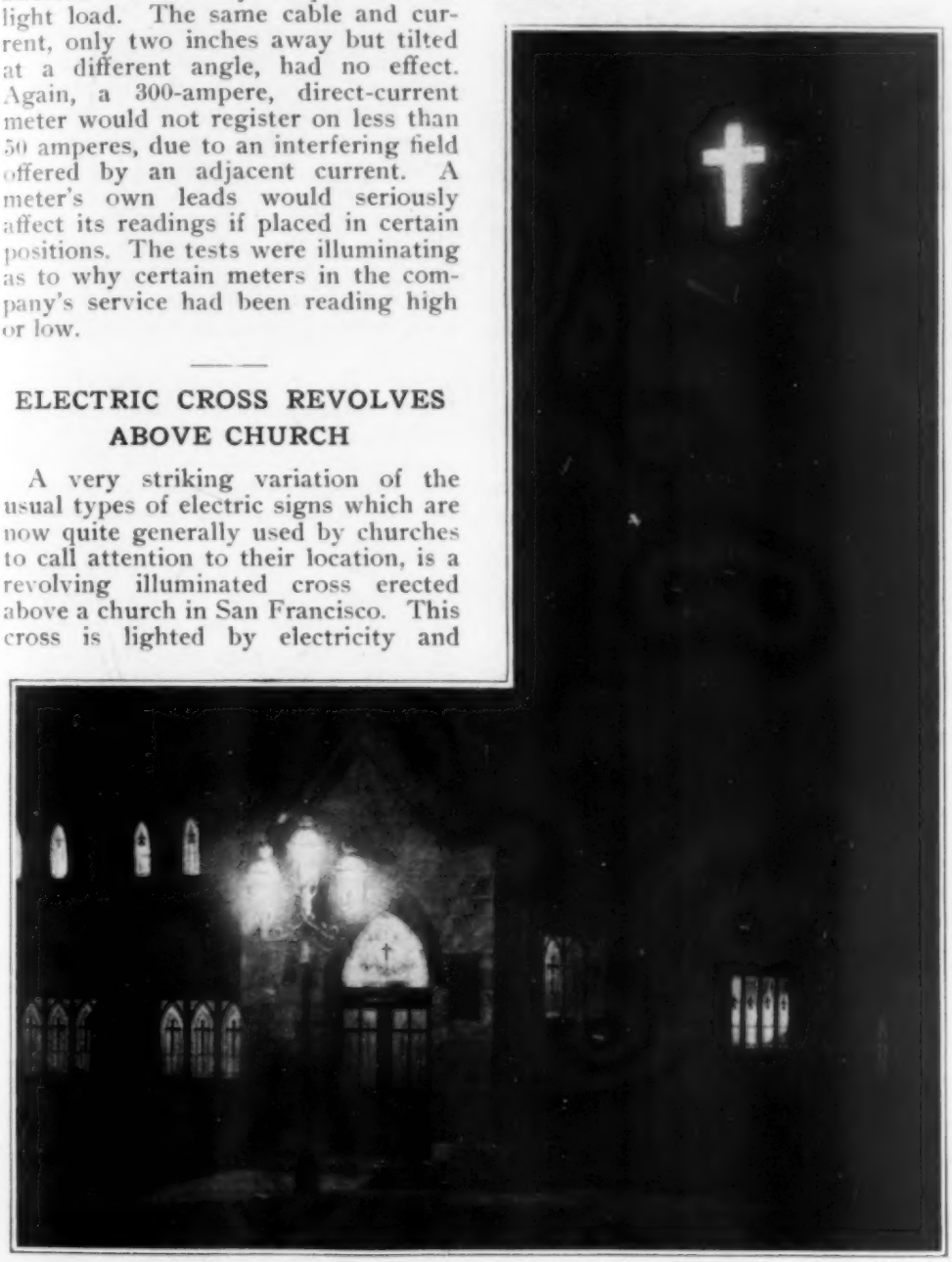
METERS ARE AFFECTED BY NEIGHBORING CURRENTS

In an effort to settle definitely just what effect the proximity of heavy electric currents has on the registration of electric meters, an eastern power company recently made extended tests. As a result it was determined that meters on a control panel, or other switchboard, should be set at least 15 in. apart, kept away from iron

girders, or the like, and the leads run in horizontally from the left side. In the tests conducted, it was found that a cable carrying 600 amperes at a 12-in. distance from a direct-current meter, affected its accuracy 50 per cent on light load. The same cable and current, only two inches away but tilted at a different angle, had no effect. Again, a 300-ampere, direct-current meter would not register on less than 50 amperes, due to an interfering field offered by an adjacent current. A meter's own leads would seriously affect its readings if placed in certain positions. The tests were illuminating as to why certain meters in the company's service had been reading high or low.

ELECTRIC CROSS REVOLVES ABOVE CHURCH

A very striking variation of the usual types of electric signs which are now quite generally used by churches to call attention to their location, is a revolving illuminated cross erected above a church in San Francisco. This cross is lighted by electricity and makes two revolutions a minute. At night it attracts attention for long distances and presents a very beautiful appearance. It was the invention of one of the members of the church which it adorns.



This Electrically Lighted Cross above a San Francisco Church Revolves Twice Every Minute

High Wind Overthrew This Flagpole, from the Top of Which, in Winter, a Signal was Displayed to Show the Condition of the Skating

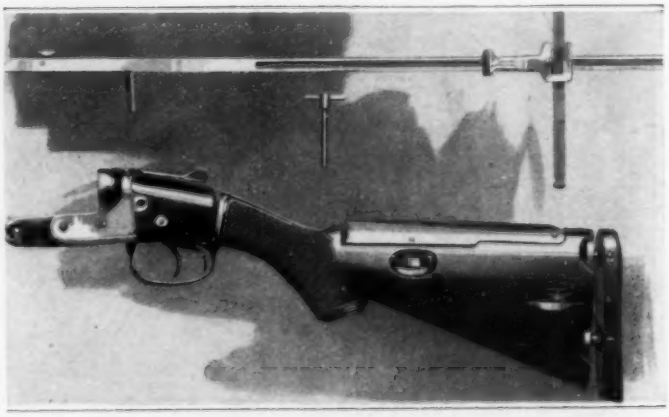
RHODE ISLAND FLAGSTAFF FELLED BY GALE

A high gale recently blew over and broke a 150-ft. flagpole which had long been a landmark in Providence, R. I. The site from which the broken staff has now been removed was the second occupied by the pole. Formerly a large red globe on the top of the staff was lighted, in winter, when the skating was good, thus furnishing welcome information to thousands of Providence young people. A careful examination of the photograph shows that the top of the pole struck the billboard on a building across the street. The red globe, which was 1 ft. in diameter, crashed through the roof below.

¶Hot water from a hose was employed recently to release a wheelsman from a pilot house of a lake boat in which he was imprisoned by a coating of ice which had accumulated during a storm.

TAKING THE MEASUREMENTS FOR SPECIAL GUNSTOCK

In making guns to order for individual sportsmen, an adjustable form is being employed which permits the proper measurements for a special stock to be readily determined. Men of different statures require various lengths and types of stocks, and this device enables a pattern to be tried before an order is rendered to a factory. It consists of a stock quite of the usual shape, but so arranged that the top edge may be raised or lowered and the butt extended and tilted to different angles by turning a series of screws sunk in the body of it. After the desired pattern has been obtained in this manner, its dimensions are taken with a special steel measure which resembles an adjustable square. In this way the finished stock meets the requirements of the man for whom it has been made, just as a tailor-made suit fits a person better than stock garments.



By Making a Few Adjustments the Proper Pattern for a Stock may be Determined

MUSIC FROM THE AUDION LAMP

By LEE DE FOREST, PH. D.

"In all my work with the audion—and I can imagine no device in the whole realm of practical physics of greater fascination than this little instrument—I have never found any phase of its unlimited possibilities quite so interesting as this, the production of musical tones. The idea of producing beautiful tone effects by an entirely new method, unknown to all our great composers and perhaps offering to future musicians new fields for their genius, is alluring. I hope ere long to produce an instrument along these lines, sufficiently developed so that it can be turned over to musicians to work out the thousand and one details of perfection which such men alone are capable of achieving."—Page 198.

IT may be, I believe, a matter of general interest to understand in brief the development of a vague idea from the most rudimentary form up to the various applications which already have revolutionized our methods of communication, and which still holds possibilities beyond our imagination to limit.

In the year 1900, in Chicago, when I first began experimenting with wireless-telegraphy receivers, I worked at night underneath a Welsbach burner in my room. I was experimenting then with an electrolytic type of receiver which I believed would have some advantages over the coherer. One night I noticed that whenever I operated the little spark coil, which I was using as the transmitter in my experiments, the gas light over my head dimmed, and brightened again when the spark stopped.

By frequent recurrence this phenomenon forced itself on my attention. I thought that here accidentally, without any premeditation, I had come across a most astonishing discovery; that the electric waves radiating from that spark were actually affecting the light of the lamp above me, and this to a surprising degree. For a day or two I believed that I had discovered something very startling. However, I soon realized that the effect was an acoustic phenomenon, dealing with sound waves entirely, and had nothing to do with the electric qualities of the spark. It was merely the effect of the sound waves of that spark on the gas in the mantle. I found later that I could obtain the same effect on the mantle by clapping my hands or jingling a bunch of keys!

Though disappointed to find that this "discovery" was not such, it had nevertheless set me thinking. I was determined now, that there was, hidden in that incandescent mantle or flame, a principle or phenomenon whereby the electric waves did produce some change—if not in the light of the lamp, then perhaps in the ability of the flame to conduct electric currents. I thought and studied with that idea tucked away in my mind for two years.

In 1902 I was first able to secure actually the effect I had been looking for, in a Bunsen gas burner, which I used for the first time then as a detector for wireless-telegraph signals. It was a very crude detector at first, but it proved that the principle existed. I applied for a patent at that early date. In 1903 I recommenced these experiments, and obtained a fairly sensitive receiver with a gas flame. In 1904 I had developed the idea to a point where the sensitive gas should derive its heat not from a gas flame but from an incandescent filament, where one would at once get away from all the troubles attendant on gas lamps and flames. When the first incandescent lamp "responder" was tried out it was found that, in addition to its convenience, its sensitiveness was also very much increased. In 1905 I obtained a device that showed much greater sensitiveness than that of any detector of that period. My assistant, Mr. C. D. Babcock, who was my constant and indefatigable helper through all this early work, suggested the beautiful and very appropriate title of "audion" for the incandescent-lamp detector. The word "audion" is made up of two derivatives: "audio," to hear, and "ion";

ions being the carriers of the electric charges traveling inside the exhausted vessel, by whose agency the electric current traverses the gap between the hot and cold electrodes. That word "audion" has been widely used ever since, as applied to this type of detector. These ions, or electrons, migrating all the time from the hot filament to the cold plate sealed within the lamp, impelled by the potential of the battery in the external circuit, carry the current through the telephone receiver, which is also in the circuit with that battery.

The current-carrying properties of these ions—their electric activity—depended, I found, to a remarkable degree on the electric stresses set up in any way whatever within the bulb. It occurred to me, therefore, that if I should insert another electric conductor near or between the filament and the plate, and then lead the exceedingly weak electric impulses from the received wireless signals to that third electrode, I might obtain an increased effect in the telephone receivers connected to the cold-plate electrode. Here then was the beginning of the audion as we know it today, the use of that intermediate electrode. This third electrode was originally put outside, then built in the form of a grid bent back and forth in zigzag fashion, and put in the lamp between the filament and the plate. Immediately I obtained an enormous increase in the sensitiveness in the bulb; the "grid" electrode is the secret of the extraordinary sensitiveness of the audion. And that grid electrode has ever since been used in all forms of the audion or "gas relay." A little later, when I began my experiments with the wireless telephone, the audion, having proven itself to be far more sensitive than the other types of detector which had been employed in wireless telegraphy, was exclusively used; adopted, in fact, by almost all experimenters in that new field, because the wireless-telephone signals are at best very faint, and one needs the most sensitive detector possible for that purpose.

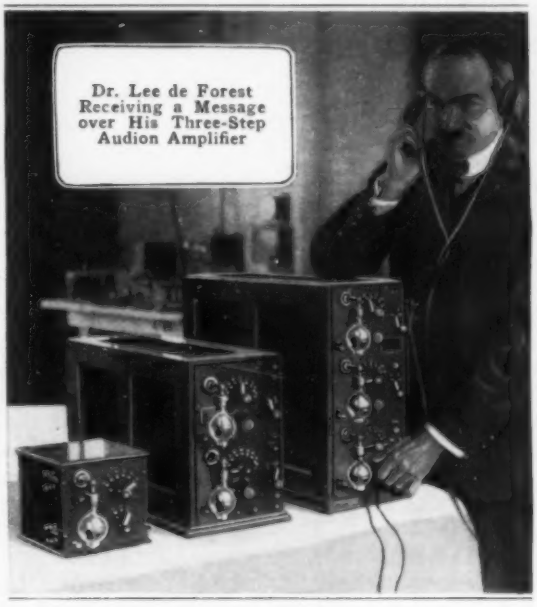
But to resume; in 1908 I discovered that in addition to being a detector and relay of high-frequency wireless waves, this little audion was also an amplifier of telephone currents. I took an ordinary telephone line and by putting in resistance cut down the strength of the current until the voice was below audibility—too faint to be understood. Then, leading that weak current to the grid and the filament of the audion amplifier, and connecting my telephone receiver as before between the plate and the filament of the amplifier, I found an increase (at first very slight) in the current in the telephone receiver. This telephone repeater was crude at first, but later developments, carried on particularly in California, showed that it could increase the volume of the voice currents 10 and even 20 times; so that we could get loud telephonic speech through the audion from voice currents which were originally too faint to be detected, or at least to be understood.

In 1912 this audion amplifier was brought to the attention of the engineers of the American Telephone and Telegraph Company, who had been for many years searching for an adequate amplifier, or repeater relay, for their long-distance telephone lines. The telephone repeater was a problem on which telephone engineers had been working for 10 or 15 years, without obtaining satisfactory results. Many mechanical amplifiers, or telephone repeaters, had been built, involving the utmost mechanical ingenuity, but they all used the same principle, that of a telephone receiver talking into a telephone microphone.

In order to make that device sensitive it was necessary to use the most careful adjustments, and those adjustments, it was found, would not remain constant any length of time. Changes of temperature in the room, or changes of atmospheric pressure, would cause that delicate adjustment to fail so that the device required constant attention, or "nursing," by expert assistants or operators. Thus, as a practical wire-

telephone amplifier, this electric-mechanical repeater had proven itself a most costly failure. Various engineers of the telephone companies had spent very many thousands of dollars in attempting to develop the telephone amplifier.

When I brought the audion amplifier to the attention of a well-known electric manufacturing company's engineers in 1912 I was really amused at the skepticism with which they received the device. They had heard about the audion amplifier, but apparently had never succeeded with it in an experimental way. I took to them a device which was very much like this instrument, which is illustrated here, not in such a finished form, but with one, two, and three audion lamps. I showed them how, with a telephone receiver—an ordinary Bell telephone receiver—as our transmitter (which everyone knows is a very deaf kind of a transmitter) in connection with one audion bulb only, one could hear in another high-resistance telephone receiver the faintest whisper. If I whispered in the phone very faintly one could hear perfectly clearly a whisper in the other telephone receivers—sounds which, if one merely connected a cell in circuit between the two telephone receivers, one used as transmitter, the other as receiver, could not be heard at all. Then I connected in a second audion bulb, so that the amplified currents of the first audion went in the second, and then had the telephone engineers listen to the telephone connected to that second bulb. They now found that this receiver used as a telephone transmitter, became actually "microphonic," so that by hanging it a few inches above the floor they were able to hear the sounds of a typewriter in an adjoining room, 30 feet away, where without the audion amplifier the telephone receiver was absolutely deaf to such sounds. Then by going one step farther and putting in a third bulb, they found an amplification of sound from several hundred to a thousand times in magnitude.



Dr. Lee de Forest Receiving a Message over His Three-Step Audion Amplifier

We have then at last a practical telephone repeater, without moving parts, and one which possesses a sensitiveness unlike anything possible with moving mechanical parts. You can readily understand that. Here inside this bulb we have an exhausted atmosphere containing "ions," which are pieces of fragments of molecules of gas, or electrons, which are, if you like the term, "atoms of electricity." You can't conceive anything finer, or smaller, or more intangible than those ions or electrons—those little invisible things which are flying back and forth and being affected in their excursions by the slightest electric charge which comes in on the grid. They are the little things that do the work. Comparing that little lamp with an ordinary telephone microphone and receiver is like comparing a soap bubble with a load of coal! When you are dealing with matter of this intangible character you will easily understand how a scientist might obtain results which are absolutely impossible

to secure with any mechanical arrangement.

The American Telephone and Telegraph Company experimented with the audions which I turned over to them for a year, and then finally approached the owners of the patents for licenses for wire-telegraph and telephone purposes. They secured those exclusive licenses for wire purposes; and within eight months after they had secured the licenses they achieved what they had been vainly striving for for 10 years, a transcontinental wire telephone from New York to San Francisco.

The sound of the unamplified voice from New York is very faint at Denver —Denver was the limit to which it was possible to transmit the voice until the advent of the amplifier. With it, however, there is no limit for overhead-wire line communication. If it were commercially feasible, you could string wires from here to the southern end of South America, putting in a small number of audion amplifiers at various points along the line.

Throughout all the years that the audion, first as wireless detector, then as telephone amplifier, was being developed, new and interesting facts were discovered. I will cite one or two instances:

In my early attempts to use the audion amplifier as a telephone repeater for standard circuits, where it was necessary to amplify the currents coming from both directions on the line, it was observed that the audion would set up alternating currents in these lines. These alternating currents became in fact very troublesome at times, setting up loud and persistent singing in the telephone receivers. The impulse of the original transmitter currents in the "grid" circuit of the audion would of course cause similar but intensified currents in the "plate circuit." But in a "two-way" telephone line it is essential to associate the incoming and the outgoing circuits through the two windings of a transformer. Then I found the impulse in the "plate" circuit would react through the transformer on the "grid" circuit, and this secondary impulse on the grid would again cause another amplified impulse in the "plate" circuit. Thus the audion and its two circuits, inductively associated, became the seat of persistent alternating currents which were in my telephone experiments a nuisance until special means were employed to suppress them, or prevent the system from "oscillating."

As an alternator, or source of undamped electric currents, however, this audion system offered most interesting possibilities. First of all, for low-frequency work, it was observed that the pitch of the note in the telephone receiver could be easily and simply varied by changing the capacity of the inductance in the circuits. This can be done very easily by a sliding contact, or simply by turning the knob of the condenser. In fact the pitch of the note can be changed by merely putting the finger on certain parts of the circuit, or even by holding the hand close to parts of the circuit. In this way very weird and beautiful effects can be easily obtained.

At the earlier stage of these investigations I found that the pitch of the note could also be varied by a simple resistance arrangement, such as a graphite-pencil mark on a piece of paper connected between parts of the circuit, and that this afforded the most ready means of altering the pitch and quality of the notes. I found it would be a comparatively simple matter to arrange a crude scale similar to that of an organ, with switches in place of the ordinary keys, so that by pressing certain keys I could cut out, or in, more or less inductance, or capacity, or resistance, thus changing the notes emitted from the telephone receiver, at will.

In order to bring the volume of sound out large and full in the room it was necessary to connect a number of loud-speaking "reproducers," similar to telephone receivers provided with horns. With these distributed in different parts of the laboratory, or grouped together in one place, the

Doctor de Forest and an Assistant Making a Test of the Oscillating Audion

Samples of the Audion: The First Three to the Left Are of the Oscillating Type, Others Are Audion Detectors and Amplifiers

The Audion Amplifier Lamp Which Made Possible the Wireless-Telephone Communication between Washington, D. C., and Hawaii

sound was made to emanate from all quarters of the room or from one corner, as desired.

Under certain conditions I found that the quality of the notes obtained from the telephone receivers connected to the "self-impelling" audion, as just described, could be made very pleasing to the ear, or weird and raucous—in fact, that the sound produced could take on an endless variety of qualities, imitating, say, that of a flute, reed-wind, or stringed instruments. With audion bulbs as large as three inches in diameter very intense sounds can be produced—ample to fill a large auditorium.

Several years ago, it will be remembered, an elaborate undertaking was launched for producing music from a large number of electric alternators, "mixing" the "tone currents" from the hundred or more machines in accordance with the wishes of the skilled performer, who in that way produced musical tones of large volume from telephone reproducers, and which simulated those of almost every instrument in an orchestra. The idea was to generate this music at a central station where highly trained organists were constantly at the keyboard, and distribute it through telephone wires throughout the city to hotels, restaurants, lobbies, concert halls, and private residences. The plan was most meritorious and deserved success. But the heavy cost of the original plant, the maintenance of the telephone cables, etc., rendered it commercially a failure.

Now with the audion or incandescent lamp as a generator of musical tones we have on a small scale all of the possibilities of the large telharmonium. Each audion bulb with its associated oscillating circuits becomes the equivalent of such an alternator, as a source of sustained pulsating currents, but at a tithe of the cost, bulk, and weight of the alternator machine. Moreover, whereas a given alternator could produce but one note of definite pitch and quality, the audion circuits can be readily changed so as to alter the pitch and

quality of the note emitted by the telephone reproducer. Graduations in sound volume can be easily controlled simply by increasing or decreasing the resistance in the circuit which lights the filament.

Where chords are to be sounded—several notes emitted simultaneously—it is preferable to use one audion for each separate note struck. Ten separate bulbs then could produce any ten notes which can be simultaneously struck by the hands of a player. Imagine each key of a piano then controlling, not a separate oscillating circuit, but a certain predetermined amount of resistance or capacity in such a circuit. If these resistances are correctly proportioned, all the various notes of the musical scale can be in this manner produced.

The alternating currents from all the bulbs are made, through the medium of the transformers, to act upon one set of telephone reproducers, so that the total energy in the form of sound is that of all the bulbs which are operated at one time.

You have doubtless all heard the peculiar plaintive notes of the Hawaiian ukulele—or mandolin—produced by the players sliding their fingers along the strings after they have been set in vibration. Those notes have not a definite pitch, but their pitch is made to vary through several notes while sounding. Now this same effect, which can be weirdly pleasing when skillfully made, can be obtained with the musical audion. It is simply necessary to vary slightly and continuously the capacity of a small "variable" condenser in one of the circuits associated with the audion while the note is sounding.

That is just one instance of the many possibilities in the use of the oscillating audion as a musical instrument. My experiments in this field, although but cursory thus far, convince me that in this new method lie developments and resources which will require the richest imagination of musical composers to picture.

In all my work with the audion—and I can imagine no device in the whole realm of practical physics of greater fascination than this little instrument—I have never found any phase of its unlimited possibilities quite so interesting as this, the production of musical tones. The idea of producing beautiful tone effects by an entirely new method, unknown to all our great composers and perhaps offering to future musicians new fields for their genius, is alluring. I hope ere long to produce an instrument along these lines, sufficiently developed so that it can be turned over to musicians to work out the thousand and one details of perfection which such men alone are capable of achieving.

It was discovered years ago, then, that in addition to being a detector and relay of high-frequency oscillations from the incoming wireless signals, the audion became under certain conditions a generator of electrical oscillations. Why then could it not be used, not merely as a detector, a receiver or amplifier, but as a generator or transmitter? It was recognized that if the audion generator could be made larger and could generate larger power, we would have a substitute for the spark—the noisy, clumsy, irregular spark—or for the very costly high-frequency alternator for wireless-telegraph, or telephone, transmission.

During the last two years the audion as a generator has been increased in size and power until, a few weeks ago, by its aid the voice was sent by wireless from Arlington to Honolulu—a distance of over 4,000 miles. Here we have the latest, and almost unbelievable, triumph of the audion, a bulb containing those three elements always, the hot filament, and the two cold electrodes, the plate and the grid.

Let me briefly describe the method used in the Arlington tests. First, we have a small oscillating audion or oscillion, with a microphone transmitter associated with its "grid" circuit. In its "plate," or output circuit, we have sustained high-frequency oscillations, the amplitude, or magnitude, of which is modulated in accordance with the voice currents controlled by the small

"master" microphone which is associated with the "grid" circuit. This high-frequency telephone current is led to the grids of several other larger oscillating audions, connected in parallel, and thereby amplified and sent out from the "plate," or output, circuits of those larger bulbs. Then the amplified oscillating energy from this second group of bulbs is again led to the "grid" electrodes of another, still larger, group of oscillating amplifier audions, and so on; until after three or four successive amplifications, we have sufficient oscillating energy, all controlled by that first small bulb and small microphone, to put 50 amperes into the big antenna at Arlington, and to be heard a quarter way around the globe. It is, you see, merely a gigantic audion-amplifier system.

But think of the expense of this method. Six hundred bulbs, costing some $15 each—$9,000 to $10,000 worth of lamps, to be renewed every month! It is a wonderful "stunt."

SNOW QUICKLY REMOVED WITH STEAM HEAT

A convenient and efficient means for quickly disposing of piles of snow which frequently obstruct city streets following a heavy snowfall, has been employed by an eastern hotel. A long narrow box made of rough lumber and mounted on low wheels is fitted with a steam pipe which extends along the bottom of the box. This pipe is connected with a steam plant in a near-by building. Workmen then shovel the snow into this box instead of into a wagon. The steam-heated pipe rapidly melts the snow, the water running off into the sewer through holes in the bottom of the device.

MAID OF ORLEANS STATUE ERECTED IN NEW YORK

With an appropriate ceremony which was attended by a number of prominent persons, among whom was the French ambassador to Washington, a large bronze statue representing Joan of Arc was unveiled recently at Riverside Drive and Ninety-Third Street, New York. The work shows the armored figure of the Maid of Orleans,

Snow Shoveled into This Steam-Heated Box Melts Quickly, and So is More Easily Disposed Of Than by Use of Wagons and Teams

COPYRIGHT, UNDERWOOD & UNDERWOOD

mounted astride a powerful charger, swinging aloft a heavy sword. Aside from its artistic qualities, the statue holds interest in the fact that the mas-

Figure of Joan of Arc Which was Recently Unveiled on Riverside Drive at New York

sive pedestal supporting it was chiseled from stone taken from the prison walls at Rouen. It will be remembered that it was at that place that the girl champion of France was imprisoned and subsequently burned at the stake as a heretic, after being captured at Compiègne and sold to the English by the Duke of Burgundy. Another significant thing is that a section of a shell-scarred pilaster from the Rheims cathedral was incorporated in the base. It was through Joan of Arc's successes at Orleans and Patay that the coronation of Charles VII at Rheims was made possible at a time when the French nation was passing through a great crisis.

CLINICAL BUILDING SOLELY FOR STUDY OF DISEASE

A new clinical building which will perform many functions of a hospital, but which will be maintained primarily for the scientific study of human diseases in patients themselves, is to be erected by the University of Illinois for its College of Medicine. Only such patients will be admitted to this institution as in the judgment of the faculty will furnish data for interesting and profitable first-hand study. Granting, of course, that the interests of patients shall be fully safeguarded, inmates will be permitted to stay only so long as their cases supply material for scientific study. Thus some will soon be turned over to regular hospitals and others will remain indefinitely. A difficulty which nearly all medical schools in this country labor under is that they have no hospitals absolutely under their control where diseases may be studied under such regulations as those proposed for this establishment.

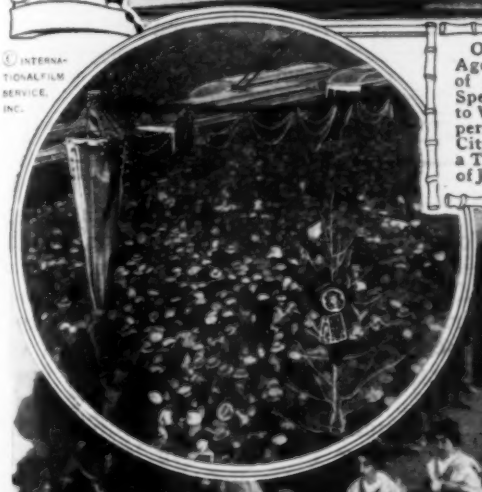
SIGHT FOR ARMY RIFLE SET FOR TOO LONG RANGE

One of the fruits of the brief but practical experience which United States soldiers have had in connection with recent Mexican affairs is the discovery that apparently the battle sight of the Springfield rifle is gauged for fighting at too long range. The rear sight is so arranged that when the leaf lies flat the weapon is sighted at 530 yd. This is called the battle sight. Using this sight on an object 200 yd. distant, the trajectory, or curve, of the bullet carries it 28 in. above the object aimed at. The idea of the rifle designers seems to have been that most of the fighting would take place at about 500 yd. But in Texas and Mexico the distance to the enemy is more often likely to be from 50 yd. to 300 yd. Instinctively a soldier aims at an object, not above or below it, hence considerable ammunition is wasted when rifles are improperly adjusted.

ENTHRONEMENT OF JAPAN'S EMPEROR AT KYOTO

© INTERNATIONAL FILM SERVICE, INC.

Out of Respect for Their Age, the Oldest Inhabitants of Kyoto were Provided a Special Inclosure from Which to View the Arrival of the Imperial Cortege at the Sacred City, Where for More Than a Thousand Years the Rulers of Japan have been Enthroned



The Ancient Forms are Observed in the Enthronement Ceremonies. This Shows the Shrine, Containing the Imperial Treasures, the Sword, Mirror, and Jewel, Which was Escorted to Kyoto by the Emperor

In the Land of Cherry Blossoms the Geisha Girl Always Fills a Charming and Picturesque Place. This Group of Young Misses, Wrapped in Gay-Colored Little Costumes, is Shown in a Brilliant Ceremonial Procession. The Insert Above Gives a Glimpse of the Great Throng Gathered before the Palace at Tokyo before the Departure of the Emperor for Kyoto

COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

FALLEN BOULDER WRECKS MISSOURI FREIGHT

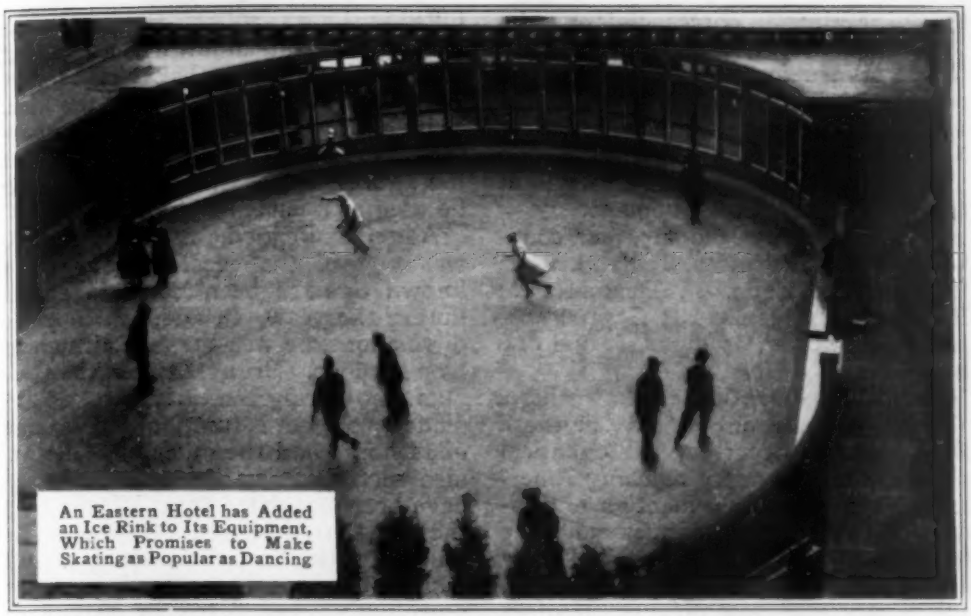
While traveling at a high rate of speed around the side of a steep bluff, a fast freight of a Missouri railroad was wrecked near Bronson, Mo., when it crashed into a boulder that had fallen onto the track a short time before. The engine, tender, a flat car loaded with heavy lumber, and an oil car plunged over the side of the bluff, the engine almost reaching the bed of the river below. The engineer and fireman, who stuck to their posts, were found alive in the engine cab, but died shortly after. The head brakeman and a tramp were killed. The accident occurred at four o'clock in the morning.

The Engine, Tender, a Flat Car Loaded with Heavy Lumber, and an Oil Car were Hurled over the Side of This Steep Bluff

An Oil Car was Completely Overturned on the Side of the Embankment and Rested Precariously above the Other Wreckage

ELECTRIC-HEATING SYSTEM ECONOMIZES CURRENT

What is pronounced one of the most complete electrical installations which has ever been made in a private residence has been placed in a 10-room frame dwelling in Spokane, Wash., for the purpose of comparing the cost of electric heating with wood and coal heat. It is recognized that with ordinary methods electricity would cost much more than these fuels, and also that the heaviest light load and heat load would occur at about the same



An Eastern Hotel has Added an Ice Rink to Its Equipment, Which Promises to Make Skating as Popular as Dancing

COPYRIGHT, UNDERWOOD & UNDERWOOD

time of the day. Hence this system now being tried stores reserve heat so that the current can be shut off from 5 P. M. to 9 P. M. It consists of an auxiliary plant attached to the hot-water system already in use. A transformer in a fireproof vault reduces the line voltage so that it can be taken by the switches, heaters, etc. The hot-water heaters have a capacity of 32 kw., and are divided into units of 1 kw. each. Two thermostats control the system. One is centrally located on the main floor and controls the water supply to the radiators. The other is attached to the boiler and governs the heat of the water in the boiler in order to store heat when the full heat is not required by the radiators. A clock mechanism cuts off the heaters when the station is carrying the heaviest load.

ICE SKATING FOR GUESTS HOTEL'S NEW PASTIME

A wholesome novelty in indoor sport which promises to become very popular is skating on ice rinks which form a part of the equipment of high-class hotels. A fashionable eastern hotel which made an ice rink for its guests early in the winter is believed to have started a movement which will extend to many other cities. Roofs or ballrooms can be transformed for the winter pastime; by the use of artificial lighting such rinks are made available at night as well as in the day. The popularity of this new departure in skating may equal that of the tango.

SUMMARY OF YEAR'S DEATHS DUE TO AERIAL ACCIDENTS

According to what are unquestionably incomplete statistics, 107 airmen and passengers met death as the result of aeroplane accidents during 1915. This number includes a few fatalities that occurred in the previous year but were not reported until after the first of January a year ago. While many of those embraced in the casualty list were military fliers, their deaths were due to accidents and not to conditions directly attributable to the war. Army airmen killed in action at the front are not considered as among those who died because of aeronautic mishaps.

The toll of American lives reached 14, three of whom were passengers;

one, a newspaper correspondent, who was killed during a flight with Lieutenant Warneford in England. The most prominent of the group was Lincoln Beachey, who was killed at San Francisco while attempting to make a spectacular dive in a very light and poorly braced monoplane.

The deaths reported in other countries were: Argentina, 3; Belgium, 5; Bulgaria, 2; Chile, 1; Denmark, 2; England, 28; France, 29; Germany, 8; Italy, 6; Sweden, 3; Japan, 5, and one in Spain.

Germany's fatalities, as shown here, are undoubtedly only a part of those that actually occurred. Aeronautical papers of that country reaching America have contained no mention of accidental deaths among airmen, and the only figure available is compiled from casualties reported by French, British, and American correspondents. No data whatever has been received from Russia, Turkey or the British possessions, where some accidents surely must have happened. It is useless even to guess at the number of fliers who were killed in the war zones. For some time French aeronautical journals attempted to publish lists of fallen airmen, but were finally forced to give up the idea. British aviation papers have enumerated some of that country's losses, but the figures have been too uncertain to be used as a basis for an estimate.

Adolphe Pégoud, the Frenchman, was one of the most famous fliers known to have been killed in action during the year. In addition to other distinctions, he was the first airman to loop the loop. Bruno Langer, the German who during the early part of 1914 made two record duration flights, one of 14 hours and the other of 16 hours, also met death in the war. Reports have been circulated from Vienna that the Russian designer, Sikorsky, was killed in action in Galicia. This rumor is probably unauthentic, as it has been repeatedly contradicted in dispatches from other places. Prominent in the German list of accidental deaths is also the name of Anton Klubel, the inventor of a material used in rendering the wings of air craft transparent.

BOAT BOUND FOR ALASKA HITS HIDDEN ROCK

WHILE steaming up what is called the "inside passage" on its regular run to Alaskan ports, the steamship "Mariposa" struck a hidden rock near McLaughlin Bay, B. C., and became badly damaged. All the passengers were safely transferred to other steamers. The accompanying illustration is from a photograph taken shortly after the accident. A salving crew succeeded in floating the boat off the rock, after which it was repaired. The inside passage is used daily by many boats plying between Seattle and Alaska.

BURIED SHELLS FOUND BY INDUCTION BALANCE

This Instrument Detects the Presence of Shells or Other Metal Buried in the Soil, Thereby Enabling the Farmer to Remove Them before Tilling a Field

The tilling of French fields, recently the scenes of battles, has proven so dangerous a task because of numerous unexploded shells found in the soil, that a French professor has devised an instrument by means of which shells or fragments may be detected even though imbedded in the soil as deep as 16 in. This instrument is an adaptation of the induction balance and consists essentially of a bamboo rod at the end of which is a wooden cross arm which supports at either end a coil having a primary and secondary winding. These coils are carried over the battle field by an attendant who holds them close to the earth. He is followed by an observer wearing a head receiver, similar to those worn by telephone operators. This is connected with the coils by wires. Other parts of the observer's apparatus are a dry-cell battery, condenser and interrupter, etc. When the coils come close to an iron or steel object a buzzing sound is produced in the receiver. Experienced men can differentiate between sounds produced by shells and by fragments; their depth also can be calculated. It takes a little over an hour to explore an acre.

DISPERSED GUNS BETTER THAN BIG COAST FORTS

Experience in the present war, notably at Liège and Antwerp, has led many military experts to the conclusion that coast-defense guns should not be concentrated in forts, but dispersed and concealed. Howitzers of 12 in. and over are pronounced preferable to other guns. Money spent on ordnance is more effective than money spent for armor; light shrapnel-proof, splinter-proof shields for such ordnance being regarded as sufficient.

IN WAR-STRICKEN SERBIA, A LAND OF RUIN

Many Refugees Returned to Their Homes upon being Assured of Protection by Teutons

In the Retreat before the Austrian and German Armies, Trains and Every Other Available Means of Transportation were Crowded to Capacity

Fugitives Consisting of Peasants, Mostly Old Men and Young Boys, Taken in Custody by German Military Police. When Captured They were Armed

An Army of War Prisoners Concentrated in Serbian Village Street by Invading Austrian Forces

WHERE WINTER FINDS THOUSANDS HOMELESS

Native Soldiers, Carrying All of Their Equipment, Fleeing into the Mountains to Escape the Enemy's Superior Force

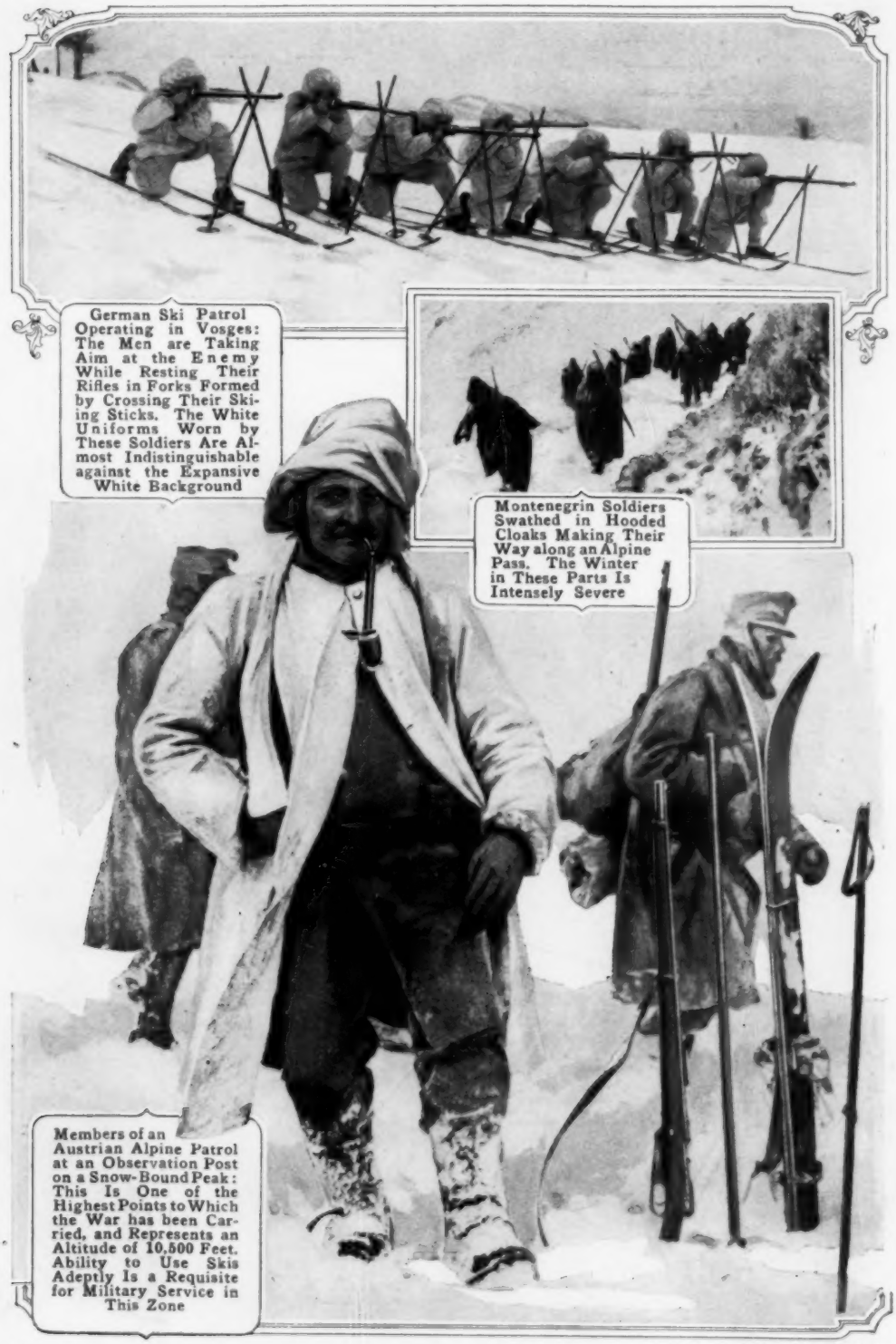
© INTERNATIONAL FILM SERVICE

Serbian Prisoners, Including Women Captured While Fighting in Trenches, in the Hands of the Enemy

Peasants Who Fled before Invading Germanic Armies Returning to Place Where Their Homes Formerly Stood. They Are without Shelter and Food

One of a Chain of Forts Commanding the Danube Leveled by Austrian Shells after Long Siege

WHITE-CLAD SOLDIERS WAGE WINTER WARFARE



German Ski Patrol Operating in Vosges: The Men are Taking Aim at the Enemy While Resting Their Rifles in Forks Formed by Crossing Their Skiing Sticks. The White Uniforms Worn by These Soldiers Are Almost Indistinguishable against the Expansive White Background

Montenegrin Soldiers Swathed in Hooded Cloaks Making Their Way along an Alpine Pass. The Winter in These Parts Is Intensely Severe

Members of an Austrian Alpine Patrol at an Observation Post on a Snow-Bound Peak: This Is One of the Highest Points to Which the War has been Carried, and Represents an Altitude of 10,500 Feet. Ability to Use Skis Adeptly Is a Requisite for Military Service in This Zone

COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

THRILLING NIGHT BATTLE IN SKY OVER LONDON

THIS remarkable photograph shows a Zeppelin attack upon London in the dead of night last October. The great German airship is outlined by powerful searchlights played upon it from defense stations guarding the metropolis. Shells which fell far short of their mark are to be seen bursting some distance below the gray fighter, and illustrate graphically the inadequacy of Britain's aerial defenses at that time. In the foreground are buildings at the entrance of Golder's Green Cemetery at Hendon.

AUSTRIAN FORCES SEEN ON TWO BATTLE FRONTS

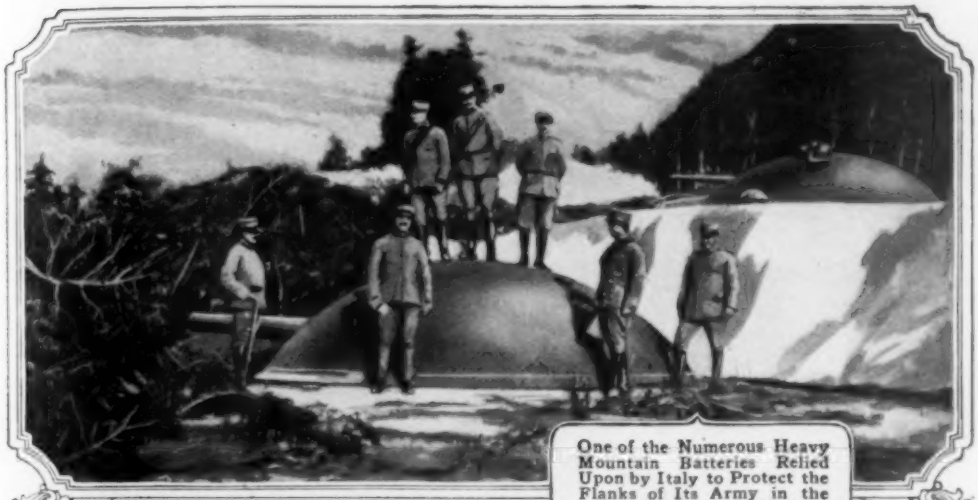
COPYRIGHT BROWN & DAWSON

Commodious and Attractive Quarters are Usually Unknown Even to Officers When an Army Is on a March. This Shows an Improvised Shelter Occupied by a Couple of Austrian Commanders during the Drive into Russia

This Mountain Pass within the Austrian Lines Presents Strikingly the Character of Some of the Alpine Battle Grounds

Clear, Fresh Water Is Frequently Little Less than a Luxury to a Soldier in Time of War. This Shows a Group of Austrian Troops Filling Their Empty Canteens While Passing a Trough on the Isonzo Front

WINTER CAMPAIGN IN THE SNOW-PACKED ALPS



One of the Numerous Heavy Mountain Batteries Relied Upon by Italy to Protect the Flanks of Its Army in the Terrific Fighting Which is being Done against the Strongly Fortified Austrian Forces in the Alps

The Thin, Staggered, Black Line Extending Down This Snow-Banked Slope Is a Column of King Emmanuel's Troops Making a Desperate Effort to Reach the Crest of the Mountain, Rout the Intrenched Enemy, and Capture Its Defenses. The Photograph Gives a Vivid Idea of the Character of the Isonzo Front, Where Some of the Most Sanguinary Battles of the War are being Waged

PHOTOS COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

RUSSIA AND THE WAR AS SEEN BY THE CAMERA

One of Many Large Rafts Which are Now being Used on a Russian River for Transporting Troops and Supplies: It is Made of Heavy Timbers and Is Capable of Carrying a Very Heavy Cargo

COURTESY OF L'ILLUSTRATION

Approximately 300 Church Bells have been Sent from Invaded Parts of Russia to the Nikolsky Monastery near Moscow to Save Them from the Enemy. Each is Labeled with the Name of Its Church

One of the Czar's Motorcycle Squads at Rest beside a Large Old Windmill Somewhere in Russia at the Front. On the Landing at the Top of the Stairs Is a Lookout

LANDING HEAVY ARTILLERY AT DARDANELLES

THE artist shows in this sketch one of the ways in which the allies some time ago carried their artillery pieces and field equipment ashore for operations against the Turks on the Peninsula of Gallipoli. The big guns were lifted from vessels held in deep water off shore, leashed to rafts, which had been especially constructed for this purpose and heavily ballasted with bags of sand, and towed in by tugs. When only one gun was taken aboard a raft the rest of the available space was used for carrying one or two large army wagons. The ballasting was done primarily to safeguard against the guns rolling and breaking loose.

INTIMATE GLIMPSES BEHIND FRENCH LINES

French Machine-Gun Battery at the Front: When the War Began France's Army was Inadequately Provided with These Important Instruments, but of Late This Condition has been Materially Ameliorated

After the French have Taken a German Trench, Troops Rush Ahead with These Entanglements and Quickly Provide a Temporary Defense against Counterattacks

Allied Trench in the Champagne District within a Stone's Throw of the German Positions. Large Quantities of Hand Grenades are Lined along Wall of Excavation

The Value of France's New Helmets is Indicated by These Headgears Which, Although Battered by Shrapnel, Saved the Lives of Their Wearers

SHOWING CONDITIONS IN WESTERN THEATER

COPYRIGHT UNDERWOOD & UNDERWOOD

First Line of Belgian Trenches in the Western Theater, Where the Enemy has been Held for Months. Graves of Some of the Fallen Line the Ditch at the Left

A Very Good Idea of the Strength of Some of the Important French Positions is Shown by This Broad, Heavily Reinforced Trench Somewhere along the Extended Firing Line

Badly Wounded German being Carried by a Fellow Prisoner into a French Camp under Guard. Many of the Captives of Both the Teutons and Allies are Wounded When Taken in Charge

GERMANS REBUILD BRIDGES RAZED BY RUSSIANS

ENGINEERING corps belonging to one of the kaiser's forces operating in the eastern theater reconstructing a bridge on the highway to Libau which was demolished by the Russians during their forced retreat months ago. At the right is a temporary structure which was hastily erected over the stream by German pioneers almost before the timbers of the original structure had ceased smoldering. The point shown here is near Skaudvily and is on one of the best roads in that part of the Russian empire.

NAVAL MINES AND TRENCH TURRETS OF GERMANS

Exhibition Ground at Whitehall Where War Trophies are Displayed: Contact Mine in Foreground Is of Type Shown at Right and Latest Found in English Waters

Cross Section Showing Interior Construction of a German Naval Mine Recovered North of Scotland by the British

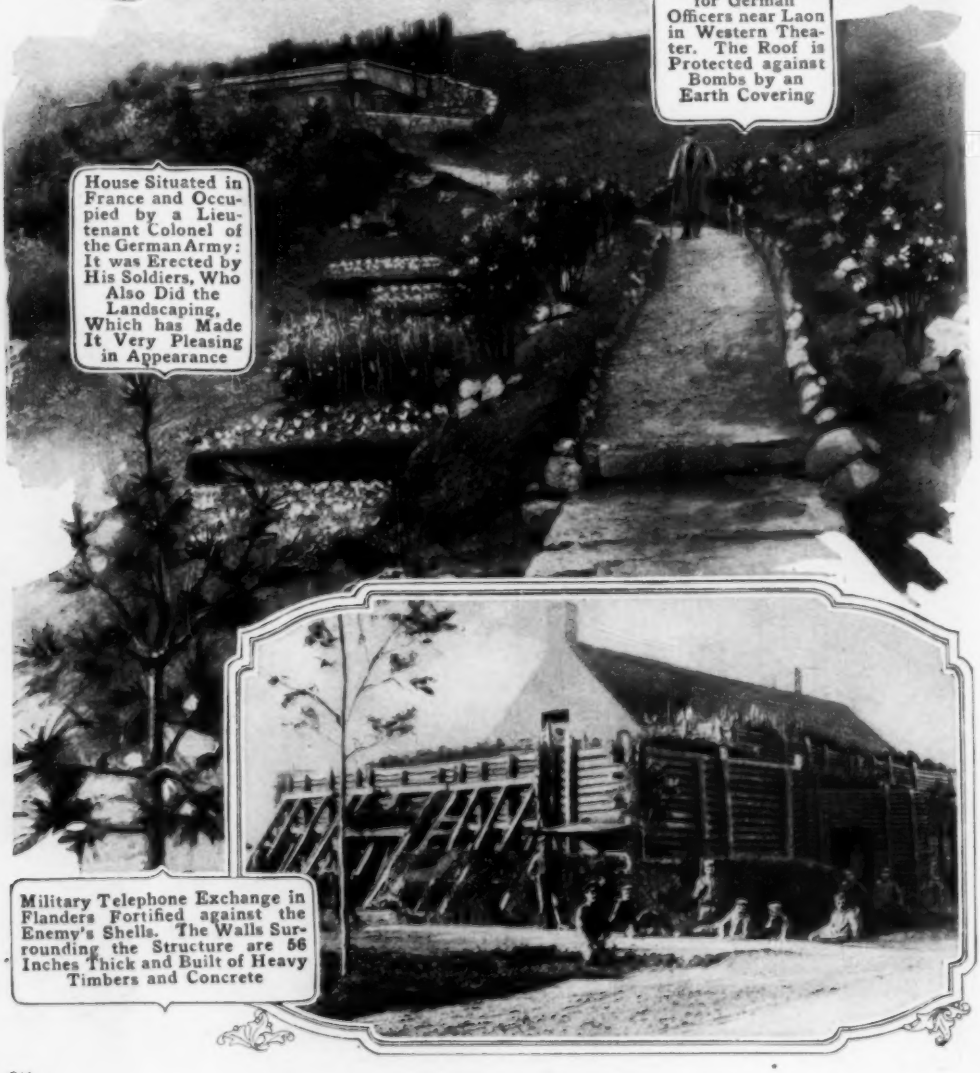
Small Gun Turrets Adapted for Use in the Trenches have been Employed by the German Forces in the Champagne District Where the Fighting has Been Severe

New Type of Portable Searchlight Employed by the Germans in Night Operations against the Allies: The Entire Equipment may be Carried by Three or Four Men and Set Up for Use in a Brief Interval, as is Partly Shown by the Accompanying Photograph Taken at the Front

COZY HOUSES ERECTED AT FRONT BY GERMANS

Attractive War-Zone Residence Built by Soldiers for German Officers near Laon in Western Theater. The Roof is Protected against Bombs by an Earth Covering

House Situated in France and Occupied by a Lieutenant Colonel of the German Army: It was Erected by His Soldiers, Who Also Did the Landscaping, Which has Made It Very Pleasing in Appearance



Military Telephone Exchange in Flanders Fortified against the Enemy's Shells. The Walls Surrounding the Structure are 56 Inches Thick and Built of Heavy Timbers and Concrete

ARMENIAN AND POLE VICTIMS OF EUROPE'S WAR

COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

Group of Armenian Women and Girls, the Survivors of a Race Which has Met Hideous Torture and Slaughter at the Hands of the Turks. Although Penniless and without Homes, These Refugees Are Free from the Grip of the Moslems

The Name, Birth Date, Residence, and Occupation of Every Individual in the Conquered Districts of Poland are Being Gathered by the Germans, Who are Also Making Tens of Thousands of Group Photographs Like the One Shown Here

ACTIVITIES OF WOMEN AND RED CROSS IN WAR

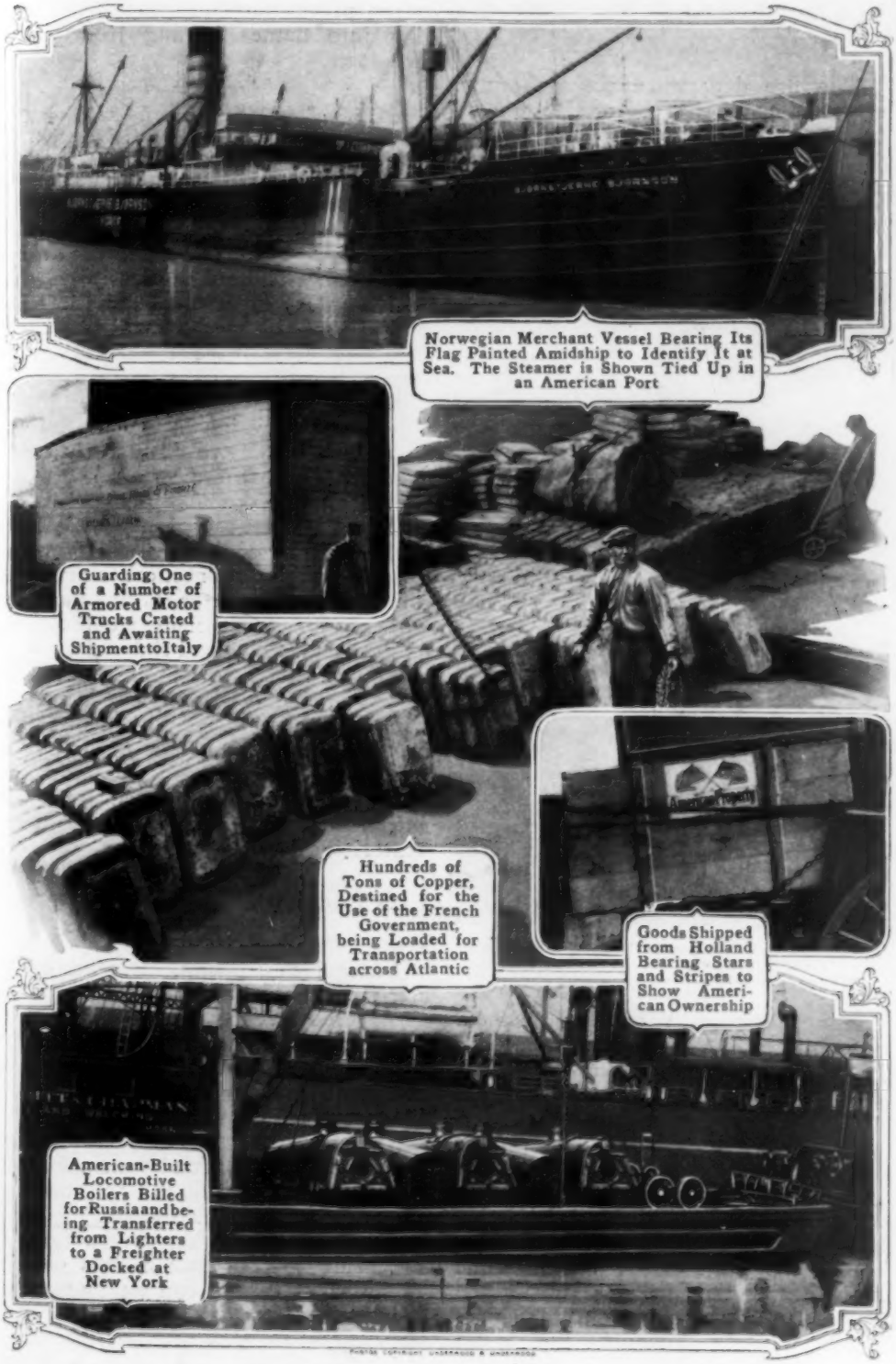
COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.
Open-Air Garden and Comfortable Little Huts for Wounded Soldiers Provided on a Roof

Uniforms of This Type are Worn by Several Thousand French Women Who are Assisting the Army

Light Vehicles Such as This, Drawn by One or Two Dogs and Carrying a Single Stretcher, are Used in Field by French Red Cross

Women and Girls Bearing Portrait of Edith Cavell during Public Demonstration in London to Raise Memorial Fund in Honor of Martyred Nurse

CONSIGNING MUNITIONS TO WARRING NATIONS



Norwegian Merchant Vessel Bearing Its Flag Painted Amidship to Identify It at Sea. The Steamer is Shown Tied Up in an American Port

Guarding One of a Number of Armored Motor Trucks Crated and Awaiting Shipment to Italy

Hundreds of Tons of Copper, Destined for the Use of the French Government, being Loaded for Transportation across Atlantic

Goods Shipped from Holland Bearing Stars and Stripes to Show American Ownership

American-Built Locomotive Boilers Billed for Russia and being Transferred from Lighters to a Freighter Docked at New York

PHOTOS COPYRIGHT UNDERWOOD & UNDERWOOD

ROPE LIFE-SAVER USED BY GERMANS AT FIRES

The fire department in a German city has made use of a simple contrivance for lowering people from

Women and Children in Burning Buildings are Safely Lowered to the Ground with This Simple Rope Contrivance

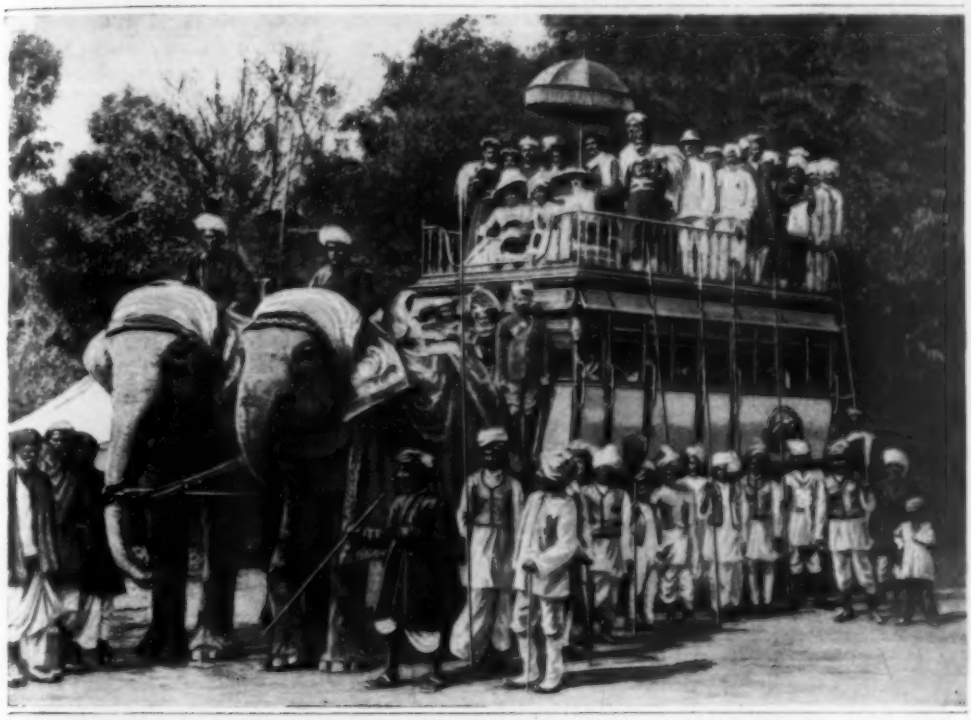
burning buildings, particularly women and children. A portable hoisting apparatus which has a long steel arm that reaches far out over the casing is quickly clamped to a window sill. A rope from the hoisting drum runs through a pulley at the outer end of this arm, and is attached to two straps which are to hold the person being lowered. One of these straps goes around the waist of the person, while the other is fastened just above the knees. In this manner a woman may comfortably be lowered, the lower strap preventing her skirts from flaring into flames issuing from lower windows.

SULPHURIC ACID MADE BY NEW METHOD

A new method of manufacturing sulphuric acid, an important advantage of which is a decrease in the cost of constructing the plant in which the acid is produced, has been successfully tried in laboratory experiments, and it is believed that the method will prove desirable for commercial purposes. An essential feature of the new process is that the gases employed are drawn downward through a spiral flue in place of being drawn through the usual lead chambers where certain necessary chemical reactions take place. In this flue the gases are mixed intimately. Its walls may be cooled by water or air, thereby making it practical to maintain the gases at the temperature most favorable for an efficient yield of sulphuric acid. The lead chambers which are displaced by this spiral, which likewise must be of lead, are vast in extent. Since a plant equipped with a spiral flue would occupy much less ground space and would not need as large buildings, nor require quite as much lead, the initial cost of construction would be materially decreased.

EXTENSIVE ASPHALT BEDS IN HONDURAS

Extensive deposits of remarkably pure bitumen, or asphalt, have been discovered recently in Honduras, Central America. Preliminary prospects reveal beds of great richness, and there are outcroppings for several miles. Since the region where these deposits have been found is considerably distant both from railroad transportation and an ocean port, it is hoped to employ motor trucks on a model highway which the Honduras government is preparing to construct in this region. If sufficient capital can be interested, it is planned to make connection with the nearest railroad also.



INDIAN WEDDING MARKED BY POMP AND DISPLAY

THE chief of Akalkot, a native state in the Deccan division of Bombay, and his guests at an Indian wedding: The party, consisting of various native and foreign dignitaries and friends, is carried in a large, ornate omnibus drawn by two elephants and attended by the host's personal guard and functionaries. The chief, who is a Mahratta of the Bhonsla family, resides at Poona and derives a pension from the state, which is now under British management.

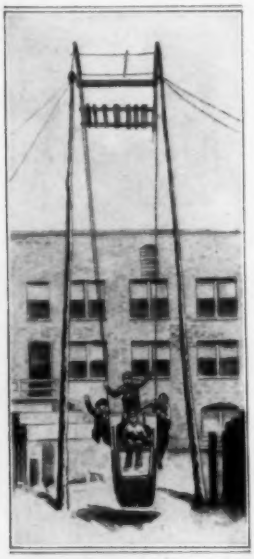
USE ICE BOX TO PRESERVE FRUIT IN TRANSIT

Shipping of fruit from the Pacific coast by "pony refrigerator" methods is increasing, according to recent reports. Through the use of refrigerator contrivances, early crops can be transported to eastern markets with little delay, and the high prices current at the beginning of a season obtained. The refrigerators are but substantial ice boxes, with a central pan for ice, and compartments for fruit at the side. They are of such size as to be readily handled in express cars, and because of the rapidity of express service it takes but five days to cross the continent with this method. In addition to fruit, experiments have been made on transporting flowers in the new ice boxes. Early California violets shipped by this plan a short time ago, arrived in New York in excellent condition. In the fruit line first boxes of spring cherries have sometimes brought as much as $25.

Fruit Shipped across Continent in "Pony Refrigerator": Boxes of Fruit Bring High Prices at the Beginning of a Season

CALIFORNIAN BUILDS SWING FOR BOYS AND GIRLS

For the enjoyment of neighborhood children, a Los Angeles mechanic has constructed a large swing with a boat-shaped carriage which is capable of holding eight or ten youngsters at one time. The framework of the contrivance consists of two 40-ft. masts, thoroughly guyed, which support a heavy cross beam. From this, wire cables are suspended to carry the load. By pulling a line attached to the top of the structure the operator of the swing is able to make it oscillate back and forth, and to a considerable height, with ease.



TO DEEPEN MINE DESPITE HIGH TEMPERATURE

Conducting mining operations at a level below the earth's surface at which the temperature would be 126.5° F. when the rock was first opened to the air, is contemplated by a mining company in Brazil. Seldom, if ever, have mining operations been attempted in higher temperatures. The depth of the proposed level would be 7,626 ft., but it is estimated that operations could be conducted profitably at that depth and even greater, providing the temperature could be artificially reduced. It is believed that under present arrangements not much more can be done in the matter of increasing the volume of ventilating air. But it has been proposed to pass down into the mine air artificially cooled. Already an air-cooling and drying plant has been designed, which, it is stated, will effectually remove this one serious obstacle to working the mine at great depth.

BENZOL OUTPUT INCREASED BY WAR CONDITIONS

Estimates by representatives of the United States Bureau of Mines indicate that in recent months the rate of production of American by-product coke ovens has been raised to approximately 25,000,000 gal. of crude benzol, or light oil, annually—an increase of 150 per cent in about a year. War conditions are given as the reason. It is said that the amount of this product necessary to make all the dyes and refined coal-tar chemicals, except explosives, used in the United States is not over 5,000,000 gal. per year.

POCKET AMMETER IS MADE IN SUBSTANTIAL FORM

For testing electric batteries, an ammeter has been invented which is designed to withstand rough usage. It is housed in a cylindrical case, at the top of which a graduated tongue protrudes when a contact is made. When not in use a cap is screwed in place to inclose the instrument and make it dirt and moisture-proof. It is capable of registering 30 amperes and is sufficiently accurate for general purposes. Its compactness permits it to be carried in a vest pocket, while it is not injured by being dropped, or by being packed in a kit with heavier tools.

¶A line of text-book print for very young pupils should not be more than an inch long and for older pupils not over 3½ in., according to some school authorities.

ELECTRIC DEVICE CONTROLS GARAGE DOORS

By Pressing a Button the Doors are Swung Back with Dispatch. The Expense of Keeping an Attendant at the Entrance is Eliminated, While Good Service is Assured

FOR installation in a public garage, where motor cars are continually entering and leaving the building, an electric apparatus has been devised for operating the doors. It is arranged so that by pressing a button located at a convenient point, the entrance may be opened or closed quickly, thus affording good service to patrons.

The apparatus is comparatively simple in construction, low in upkeep, and moderate in cost. Especially in a large garage, it effects a considerable saving, for it eliminates a door man and does away with the loss of time occasioned by mechanics and other employes leaving their work to answer repeated calls to the doors.

The device, which includes a motor that actuates a drum on which operating cables are wound, is suspended from the ceiling above the top level of the doors it serves. Three controlling buttons are used. One of these causes the doors to be opened, a second permits the mechanism to be stopped almost instantly, should this be necessitated by an emergency of some kind, while pressure upon the third closes the doors. In other particulars the apparatus works automatically. In opening the doors it is only necessary to push one of the buttons and allow the mechanism to do the rest. The motor stops as soon as the doors are either opened or closed.

When an office is situated at the front of a building, so that a stenographer or clerk is able to see machines approaching the doors from both the outside and interior, or hear their signals, the buttons may be placed on their

desks, as well as at convenient places in the garage proper. While it is especially intended for garages, it is obvious that the apparatus might be installed wherever electric operation of doors or gates is desired.

NEW BURNER CONVERTS FUEL OIL INTO GAS

With a new kind of attachment that is designed to be installed in a stove or furnace of any type, ordinary fuel

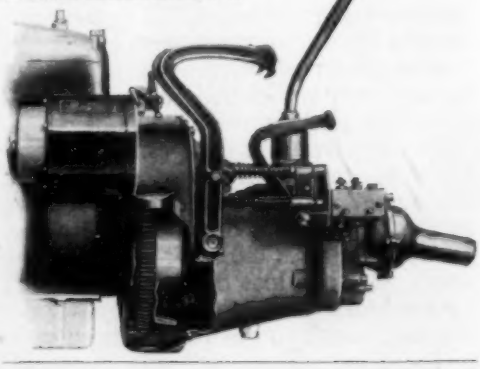
With This Device Ordinary Fuel Oil is Converted into Gas as Needed for Supplying the Burners

oil is converted into gas and in this form is used as a fuel for heating. The device consists of a single casting and is made in several sizes, and in both rectangular and circular shapes to make it suitable for different sizes and types of fire box. It is installed permanently in the fire box and is set in fire clay to prevent any passage of air except through the air ducts provided in the casting. The oil is converted into gas in the base of the burner by the intense heat of the flame. A small amount of air is admitted to the under side of the flame through perforations in the burner, but the greater part goes upward through ducts at the sides of the burner into an air drum, from which it drops directly downward upon the flame, the burned gases passing out through openings at the sides of the burner and then to the chimney. The oil tank can be located anywhere, the only requirement being that it must be placed at a sufficient height to cause the oil to flow by gravity. For starting the burner all that is necessary is to admit oil to the base of the burner, in which is loosely laid an asbestos wick, and then light the oil. By the time this oil is burned out, there is a sufficient amount of gas started to maintain the flame.

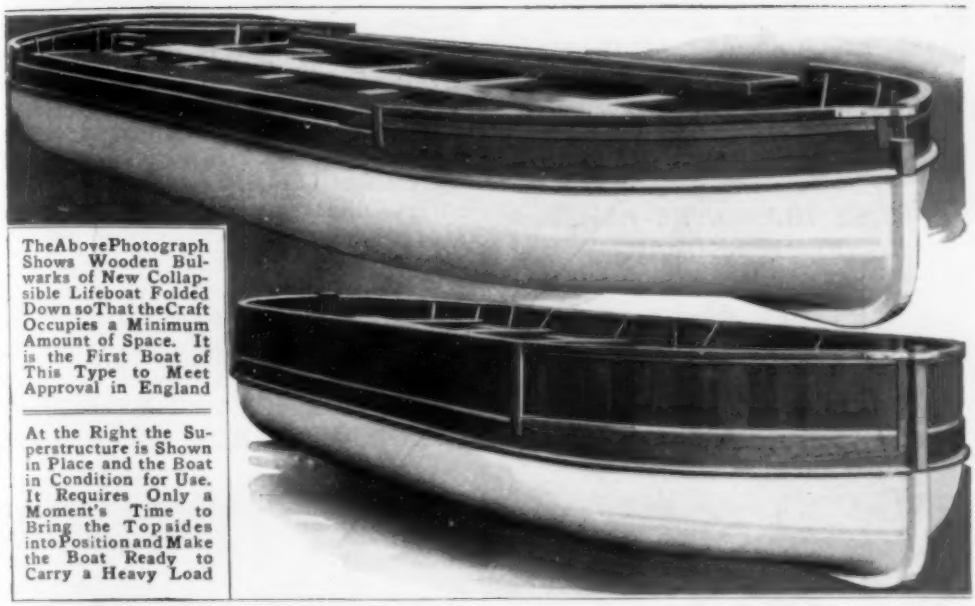
CONE CLUTCH OF MOTOR CAR RUNS IN OIL BATH

In the latest model of one of the standard motor cars a cone clutch is employed which is completely housed and immersed in oil. In place of the customary leather facing, a stout fabric is used. The purpose of this is to enable a driver to slip the clutch at will, when negotiating rough roads, without fear of burning the facing. In other mechanical respects the clutch is like others of its type, operating by contact against the inner surface of the flywheel. Since it runs in a lubricant, however, the facing is kept pliable and in good condition for uniform friction. A quart of cylinder oil is the normal

A Fabric Facing is Used Instead of Leather and is Kept in a Pliable Condition by Oil



charge used. The housing is designed so that it may be readily removed when it is desired to inspect the clutch.



The Above Photograph Shows Wooden Bulwarks of New Collapsible Lifeboat Folded Down so That the Craft Occupies a Minimum Amount of Space. It is the First Boat of This Type to Meet Approval in England

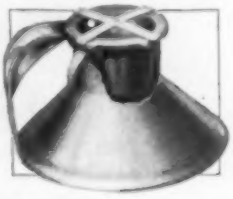
At the Right the Superstructure is Shown in Place and the Boat in Condition for Use. It Requires Only a Moment's Time to Bring the Topsides into Position and Make the Boat Ready to Carry a Heavy Load

NEW COLLAPSIBLE LIFEBOAT HAS WOODEN BULWARKS

Structural features which are believed to be altogether original are embodied in a collapsible lifeboat that was recently put through a series of severe tests before the marine department of the British Board of Trade. Instead of being constructed of canvas, the topsides, which when in position form a rigid, durable upper section, are built of wood. This form of construction was made practical by fitting amidships on both sides of the craft a straight wooden bulwark provided with a recess to receive sliding shutters. These are made of double thicknesses of mahogany in vertical strips, with canvas and lead between. Channel irons on the coaming and top gunwales provide grooves in which the shutters slide. When the latter are drawn out they complete the bulwark, but when not in use are protected from the weather and leave the fore and aft sections of the deck clear. Iron brackets connect the gunwales and seats, permitting the former to be raised simultaneously with the latter, which are supported by stanchions and may be locked or unlocked at one time. The upper stem and sternposts are joined to the deck by hinges. The hull is full-bodied and is given internal buoyancy by a series of tanks. In addition to these, cork fenders run fore and aft to within 4 ft. of each end on the outside. The boat may be opened up ready for use in less than a minute by four men. When collapsed and nested, two of the boats occupy a space 4 ft. 6 in. high. The craft is built in several sizes, the smallest of which is 26 ft. in length, and during the Board of Trade tests easily carried 57 men.

MILK-CAN COVER IS HELD IN PLACE BY GRIPS

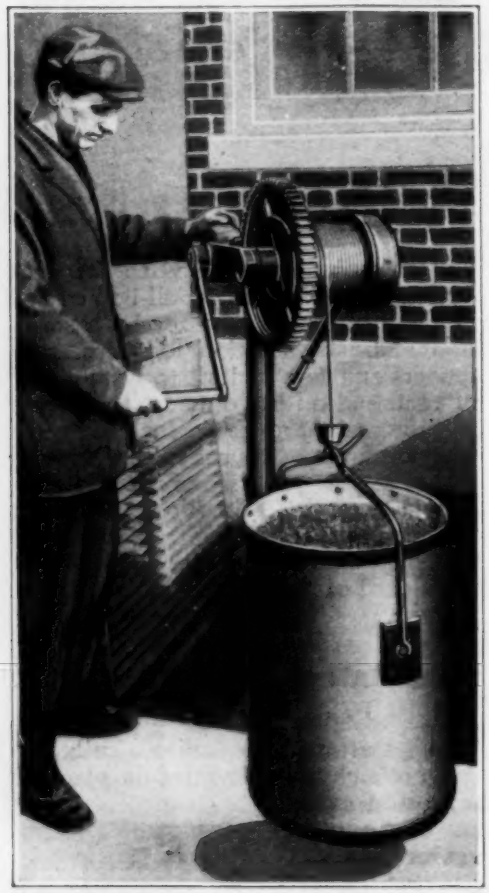
In an attempt to devise a milk-can cover which may be fitted in place or removed easily, an eastern inventor has constructed a sheet-metal stopple which is secured to the rim of a receptacle by a nest of steel grips. One of these members is a spring which extends along the neck of the can at one side of the handle.



By pulling out on this the clasp is released. A rubber gasket is used in the seat of the stopple, which is a tapering cup that slips down the neck of the can into the milk and prevents the latter from churning.

HOIST ELEVATES ASHES FROM CELLAR

Handling heavy ash cans, barrels, kegs, and the like, between the basement and sidewalk of buildings is



Hand-Operated Elevator Lifts Objects from Basement

usually attended with difficulty and sometimes makes necessary the services of two men. A hoist, however, has been invented which will do the work in much simpler fashion.

A post is mounted on a central pivot at the opening leading to the cellar. At its upper end is a drum operated by a crank and gearing. In elevating objects from the basement, the arm hangs over the opening, and the operator does the hoisting by means of the crank. On getting its load to the surface, the arm swings around on its support and deposits the burden on the sidewalk. To facilitate turning of the standard, ball bearings are provided. The whole contrivance folds down beneath the sidewalk when not in use.

ENGINEERS EXPERIMENT ON FLOOD-CONTROL METHODS

Activity of unusual nature took place in a small California valley a short time ago. Up among the rocks of a shaded ravine at one end of the little cañon, engineers constructed a masonry dam. In the center of the dam was an oblong hole, 7 ft. high and 5 ft. wide, closed by a special quick-acting gate.

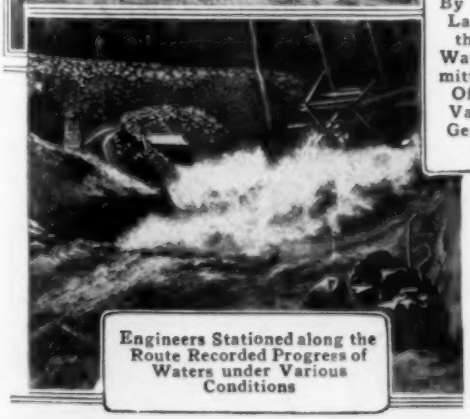
Tests were being conducted on flood-control methods—tests on a cut-and-try basis with the actual floods, only on a somewhat limited scale, due to the size of the valley and the restricted storage capacity of the area back of the dam just completed. Methods of procedure during the tests were simple. Opening the large gate in the dam permitted water to gush out and run off down the valley in imitation of a genuine flood. The time required for the water to reach given distances, as well as other pertinent data, were carefully noted by engineers located along the route several thousand feet apart. After passage of the first flood another was run, the same in detail except that the valley had been cleared of rocks, excessive vegetation, and other natural barriers to floods. Then, later, these were restored, together with barriers of the engineers' own invention, and still further tests carried out.

Los Angeles County is shortly to expend over $16,000,000 in flood-protection measures. Floods have inundated much valuable land in that sec-

tion again and again, until the district, like Dayton, Ohio, has resolved to prevent if possible, once and for all, any further repetitions of the trouble. Because of peculiar topographical conditions in that section, which embrace high mountains, steep slopes, and broad valleys, all within a limited area, engineers have found that practically all known flood-protection measures will have to be used if further inundations are to be prevented. Thus forestation, impeding and storage reservoirs, channel improvement and spreading, are all included in the proposed schedule. Because of the lack of accurate data on the precise performance of these several methods, the experimental dam and flood valley mentioned above was rigged up, and tests run. The data secured will be the means of saving much money during construction of the actual flood barriers, in the opinion of the engineers.

Test Dam 24 Feet High and 75 Feet Wide Constructed by California Engineers to Experiment on Flood Performance

By Opening the Large Gate in the Dam the Water was Permitted to Rush Off down the Valley as in a Genuine Flood

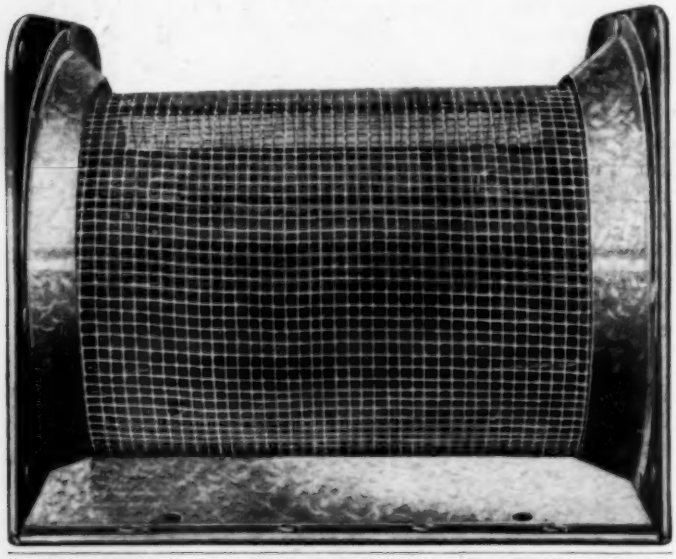


Engineers Stationed along the Route Recorded Progress of Waters under Various Conditions

FISH ARE KEPT IN STREAMS BY REVOLVING SCREEN

By the use of a rotary screen, lately invented, a method has been found for preventing fish from getting into the irrigation ditches of the West and perishing in the open fields. For a number of years the game and fish author-

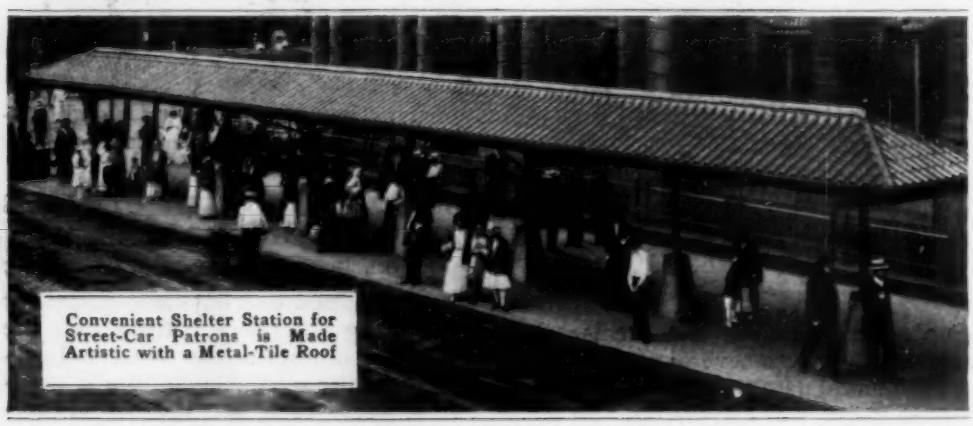
ities of Utah and New Mexico, as well as those of certain adjacent states, met much trouble in attempting to stop the wholesale loss of fish from this cause. The installation of ordinary nets to check the passage of fish from mountain streams into irrigating canals proved inadequate, because these devices caught all of the floating debris and clogged the waterways. The new screen has been adopted officially in both Utah and New Mexico. It consists of an undershot water wheel, with folding blades, which is inclosed in a cylindrical wire netting. The blades fold on the upward stroke and open on the downward one, the water passing through at the bottom. In revolving, the screen moves with the current, or in a direction opposite to that of the wheel, and carries the debris over the top. While the purpose of the net is to hold back the fish, the clanking noise made by the folding blades causes them to keep away from the obstruction.



The Revolving Screen Carries the Debris over the Top, While the Water Passes beneath the Wheel

SHELTER STATION HAS ROOF OF METAL TILE

In Cincinnati a shelter station for the benefit of waiting street-car patrons was recently erected. It faces a government building at a corner near which over 90 per cent of the city's street-car traffic passes. A feature in the design of the shelter station is its metal roof. Being shaped and painted to resemble clay tiling, a pleasing and artistic effect is given. Cincinnati is soon to have many such open-air waiting rooms erected in different parts of the city.



Convenient Shelter Station for Street-Car Patrons is Made Artistic with a Metal-Tile Roof

Mountain Stream Furnishes Power for Picturesque Printing Plant

PRINTING OFFICE HAS ODD ENVIRONMENT

What is perhaps the most picturesque printing office in the world is situated in a small town in the state of Washington. A mountain stream which runs by the plant is utilized to supply necessary power for the presses and lighting. The big overshot wheel which serves in this connection is almost half again as high as the plant itself. In addition to job printing, a little weekly newspaper is issued from the office.

NEW POST-HOLE DIGGER HAS JOINTED SHANK

Digging post holes with the ordinary spade and shovel is slow work, even if the tools are handled by an expert. The chief difficulty is getting the dirt out of the hole after it has been loosened, since the narrow confines of the shaft do not admit of much shovel manipulation. In an attempt to get around this difficulty a new form of digger has been developed. It much resembles an ordinary long-handled spade, except that the shank next to the blade is jointed in such way that the latter may be held at three different angles with respect to the handle. For plain digging as with an ordinary spade, the blade may be locked in a straight line with the handle. After getting deeper down into a hole the handle may be swung forward, causing the blade to lock at right angles with the shank, forming a horizontal carrier for elevating dirt to the surface. By this method it is claimed that a much larger shovelful can be gathered together and lifted at one time than with ordinary tools, thus allowing more rapid work. For refilling purposes, or in ditching work, the blade may be set at the third, or acute, angle if desired. It may thus act as a rake for gathering in dirt.

For Removing Dirt from Hole, However, Blade and Handle Lock at Right Angles

Spade Locks in Line with Handle for Straight Digging Operations, Acting as Ordinary Tool

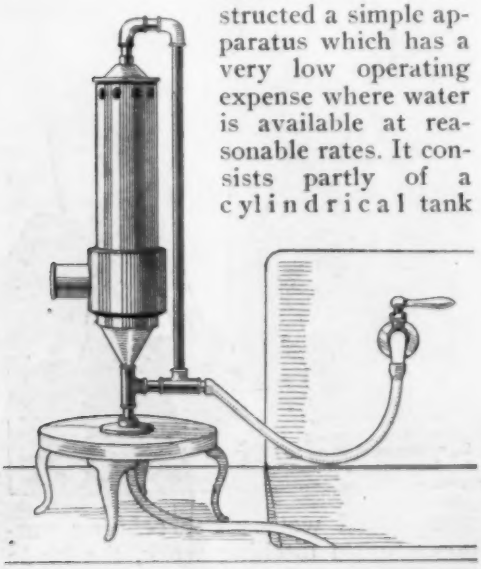
PUBLIC FOUNTAIN BUILT OF COBBLESTONES

An attractive feature that might well be copied in other cities is a public fountain, built of cobblestones, recently erected in a city in southern California. The fountain is a structure 18 ft. long, 10 ft. wide, and about 12 ft. high. With the exception of the roof, which is of red Spanish tile, and the heavy beams and rafters, the fountain is composed entirely of cobblestones and cement. At one end is a drinking fountain, and at the opposite end is a basin for dogs and other small animals, while the center is occupied by a large basin designed principally for horses. The water first enters the drinking fountain, and the overflow from this furnishes a supply for the two basins.

Cobblestone Fountain Erected in a City in Southern California

AIR-COOLING APPARATUS OF SIMPLE DESIGN

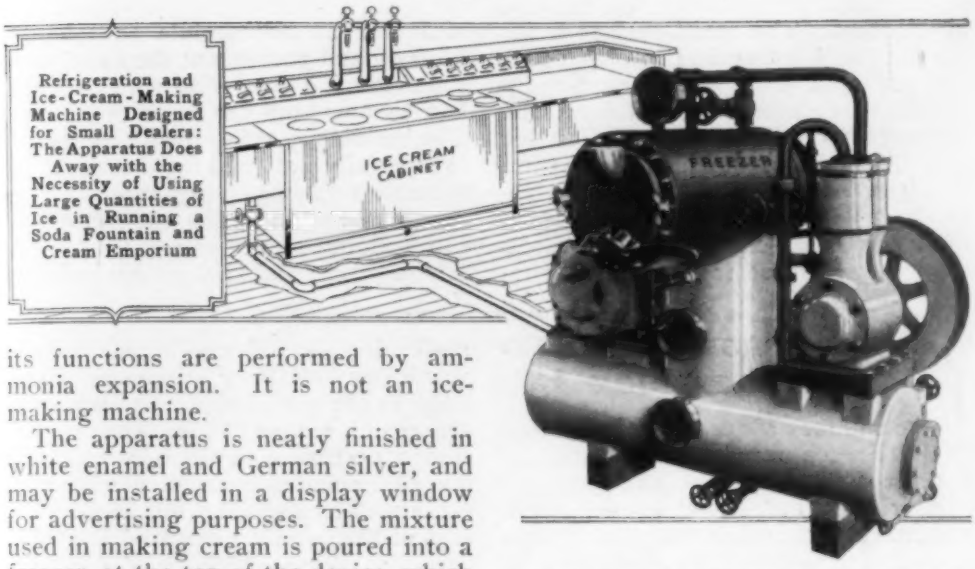
For cooling and purifying the air in a room without employing electric current, chemicals, or ice, an eastern inventor has constructed a simple apparatus which has a very low operating expense where water is available at reasonable rates. It consists partly of a cylindrical tank mounted vertically on a small standard. The lower end of this is cone-shaped and connects with a drain which carries off the water admitted at the top by a feed pipe. As the water enters the cylinder, it passes through a spray, mounted immediately above a series of air-intake holes, and strikes the blades of a fan, which it causes to revolve. The suction thus created draws air into the cylinder, where it is washed and cooled by the water which is broken up into a fine spray upon striking the fan vanes. By means of a special stop in the drain, the air is not allowed to escape from the tank excepting through a duct passing around the cylinder above the cone.



This Air-Purifying and Cooling Device may be Operated Economically Where Water Rates Are Reasonable

NOVEL ICE-CREAM MACHINE IS REFRIGERATING PLANT

Designed especially as an accessory for confectionery shops, a refrigerating and ice-cream machine has lately been introduced which is built in one unit. It is made in two sizes, the smaller of which has a maximum daily capacity of about 100 gallons of cream, and a refrigeration value equivalent to the melting of a ton of ice. Both of



Refrigeration and Ice-Cream-Making Machine Designed for Small Dealers: The Apparatus Does Away with the Necessity of Using Large Quantities of Ice in Running a Soda Fountain and Cream Emporium

its functions are performed by ammonia expansion. It is not an ice-making machine.

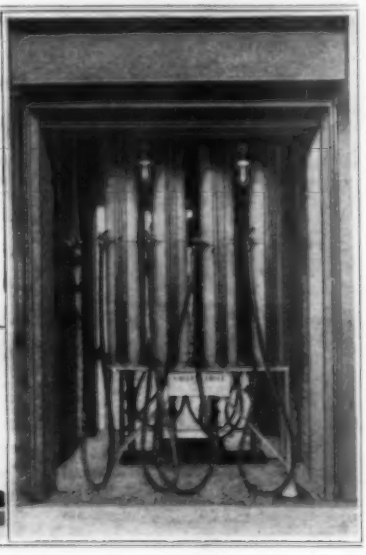
The apparatus is neatly finished in white enamel and German silver, and may be installed in a display window for advertising purposes. The mixture used in making cream is poured into a freezer, at the top of the device, which is driven by an electric motor. When frozen to a certain point, the cream is turned out and placed in a hardening cabinet, the temperature of which may be maintained at less than zero. This storage box is provided as a part of the equipment and may be installed beneath a soda fountain, or elsewhere if desired.

The machine is 54 in. in length, 2 ft. wide, and 46 in. high. It does away with the necessity of using ice and greatly simplifies the work of making cream and keeping it solid. The large size has about three times the capacity of the small one.

¶The first train to be run over the government's Alaskan railroad made the trip from Seward to Mile 29 on Nov. 8, 1915, carrying passengers, mail, and freight.

GASOLINE-SUPPLY STATION HANDLES ORDERS QUICKLY

A gasoline-filling station lately put in service in a northern city has unusual facilities for the rapid dispatch of orders. The gasoline is kept underground in eight tanks having a capacity of 500 gal. each. From these it rises to smaller tanks above ground which hold quantities sufficient for moderate users. Compressed air supplies the force necessary for the rais-

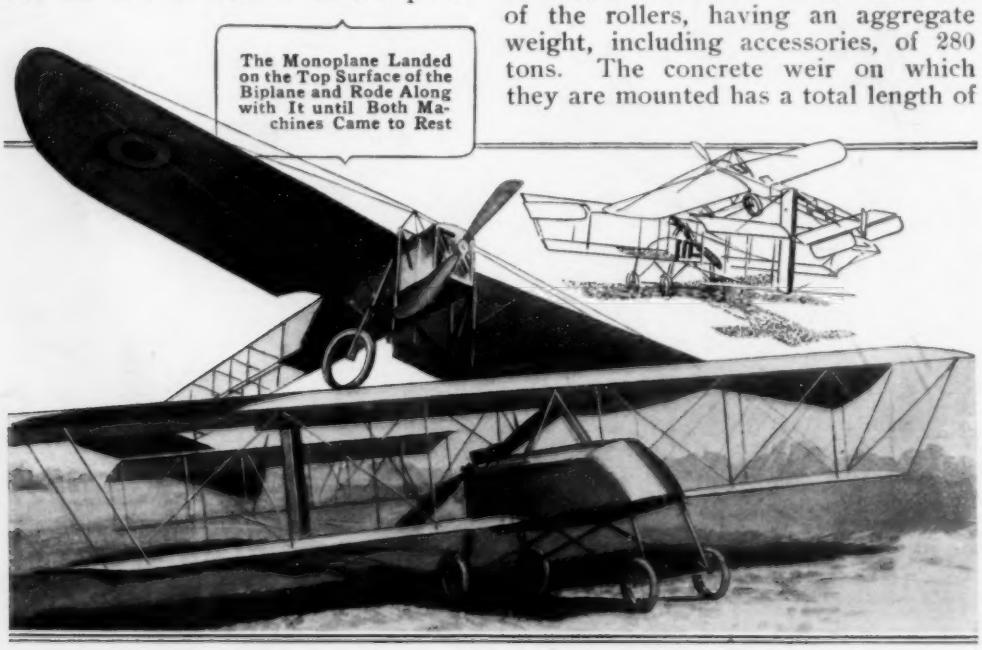


Gasoline-Filling Station Especially Designed for Automobile Sales: Gauge Glasses on the Tanks at Each End of the Building Show How Much Gasoline Customer is Receiving

ing process. The small surface tanks are long and cylindrical in shape, and are provided with gauge glasses by which a customer may follow the amount of oil being delivered to his car. Aside from gasoline, the station also handles lubricating oils, these latter being kept in a system of tanks similar to the gasoline. Since the tanks are mounted close together, it is possible for an automobile to take on both oil and gasoline at the same time, thus reducing the period which usually has to be spent for these operations. The building housing the filling station is especially designed for the work, automobiles having ready access to the gasoline supplies. The central part of the building serves as a store for the sale of grease and minor accessories.

TWO WAR AEROPLANES LAND IN QUEER FASHION

Two military air craft landed at one of the French aerodromes recently in a most odd manner. The pilot of neither machine knew of the close proximity of the other and by a strange coincidence selected the same spot in alighting. The running gear of one aeroplane, a Voisin biplane, was just about to touch the ground when a Bleriot monoplane glided down at an angle from a higher level. The latter machine slid lightly onto the upper surface of the biplane and rode along with it until the momentum of both craft was spent and they came to rest. For an instant neither of the pilots realized what had happened. No one was injured and very little damage was done to the aeroplanes. There are instances on record of somewhat similar things occurring in the air, which in one particular case ended the life of a quite well-known flier, but freak landings of this kind are unusual.

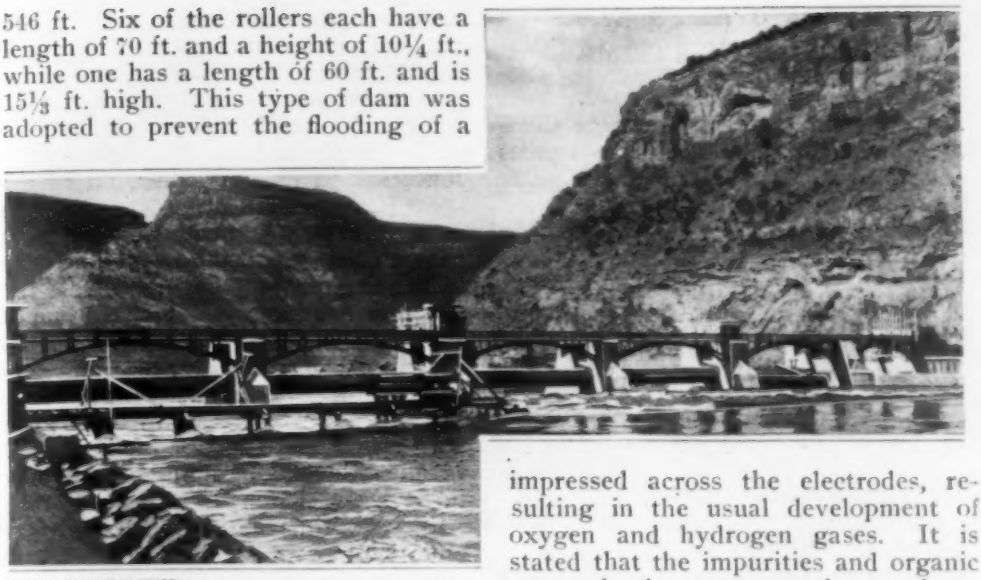


The Monoplane Landed on the Top Surface of the Biplane and Rode Along with It until Both Machines Came to Rest

WATER LEVEL CONTROLLED BY ROLLER DAM

A dam recently constructed across the Grand River in Colorado is equipped with a set of roller crests with which it is possible to maintain a practically uniform level in the reservoir in spite of the varying stages of water in the river. There are seven of the rollers, having an aggregate weight, including accessories, of 280 tons. The concrete weir on which they are mounted has a total length of

546 ft. Six of the rollers each have a length of 70 ft. and a height of 10¼ ft., while one has a length of 60 ft. and is 15⅓ ft. high. This type of dam was adopted to prevent the flooding of a railroad track located along the river bank at a level only about three feet above the mean level of the water. In order to maintain a practically constant level in the reservoir the rollers are kept lowered on the weir at ordinary stages of water, but are raised in time of flood so that the water passes under them.



COURTESY ENGINEERING RECORD

Roller Dam Recently Built across the Grand River in Colorado: All the Rollers Except the One at the Right are Shown Raised to Permit the Water to Pass through the Dam

SIMPLE MACHINE PURIFIES WATER FOR HOME USE

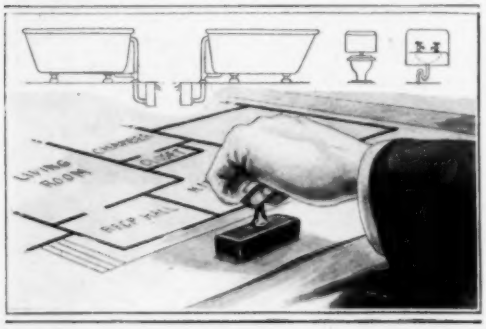
A machine, simple in design but claimed to be very effective in operation, is a late addition to apparatus available for water purification. The machine in its ordinary form is intended for the home, and is designed to handle the comparatively small amounts which are required for household use.

The apparatus is electrolytic in action. The water to be purified is held in a large glass jar, into which two electrodes project. One of the electrodes is hollow and cylindrical in shape, while the other is a round rod, and hangs within the cylinder. Current from an electric-light socket is impressed across the electrodes, resulting in the usual development of oxygen and hydrogen gases. It is stated that the impurities and organic matter in the water are thrown down in the form of a flocculent, or flaky, precipitate. This settles in the bottom of the jar, and after the machine has run for a time, the purified water may be poured off at the top. In this simple manner any desired amount of water may be rid of undesired matter.

Apparatus Which Utilizes Electrolytic Action in Purification of Water

RUBBER STAMPS SAVE DRAFTSMAN'S TIME

Architects and designers who have had occasion to draw the same thing over and over again in different parts



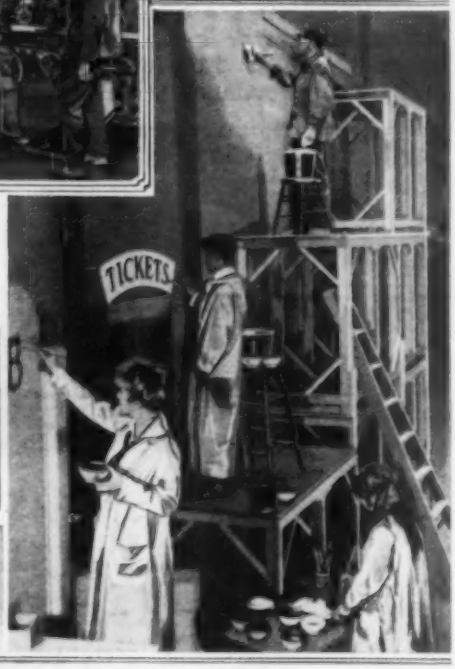
Rubber Stamps Permit the Ready Drawing In of Plumbing Fixtures

of a set of plans for a structure, will appreciate a new convenience being offered. This consists of a number of rubber stamps, designed, in this case, particularly to represent the plumbing in a building. For instance, one of the stamps prints the outline drawing of a bathtub; another depicts a kitchen sink with the usual hot and cold-water faucets, and so on. Since all of the stamps are made on a scale to fit the average drawing, their ready use is an easy matter. Instead of spending time in drawing out each fixture to scale, the designer has simply to pick up one of the stamps, adjust it carefully to the drawing, and press down. An accurate printing of the whole sketch results. This may afterward be filled in with ink if the designer likes, as well as any connecting piping which may have been sketched in with a rule. Although thus far applied only to plumbing fixtures, the rubber-stamp idea has possibilities of still wider application to other ordinary kinds of drawings.

NEW COURSES IN THE HIGH SCHOOLS OF CALIFORNIA

With the idea of training their students to engage in gainful occupations immediately after graduation, many of the high schools of the country are giving instruction in practical subjects that were not thought of as parts of a curriculum a few years ago. This tendency is particularly pronounced in California, where many new courses especially adapted to the diverse requirements of modern life have been installed. In high schools located in various parts of the state, for example, instruction is now given in the principles of automobile construction. In this work the boys are not only taught the mechanical principles involved but are set to work building and repairing automobiles, with the idea of enabling them to become competent workmen by the time they are graduated. A course that is equally popular is that in farming, and in this the school work is, as a rule, supplemented by work on a school farm. One of the largest school farms in the West is that connected with a high school at Bakersfield, Cal., where the practical farm work includes the design and erection of farm buildings. In some of the schools there is also given a course in wireless telegraphy, to which a course in wireless telephony is now being added. One of the unusual courses is that in stagecraft, given in a high school in Los Angeles. The school auditorium has a large stage on which many school plays are produced, and nearly all the scenery and costumes for these plays are made by members of the stagecraft class. The course is open to both boys and girls, and includes the making and painting of scenery, the manufacture and use of stage properties, the principles and practice of stage lighting, the designing of costumes, and the art of making up. Other especially interesting courses are the printing arts, including linotype composition, and boat building. Courses in wood and iron work lead to the boat-building course.

Left: At Different Schools Instruction is Given in Principles of Motor-Car Construction by Competent Mechanicians

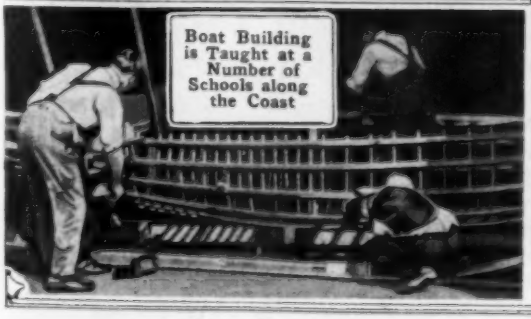


Below: Radio Installation in High School at Bakersfield, California, Where Pupils are Taught to be Operators. A Number of Institutions Provide This Course for the Boys

Below: Constructing a Greenhouse at One of the Schools Where Agricultural Training is Given

Behind the Curtain at a Los Angeles Institution Where Mechanics of the Stage are Taught: The Students Learn to Manufacture Stage Properties, Build Scenery, and Make Costumes, as Well as Other Things

Feeding a Press in the Print Shop of a Los Angeles High School

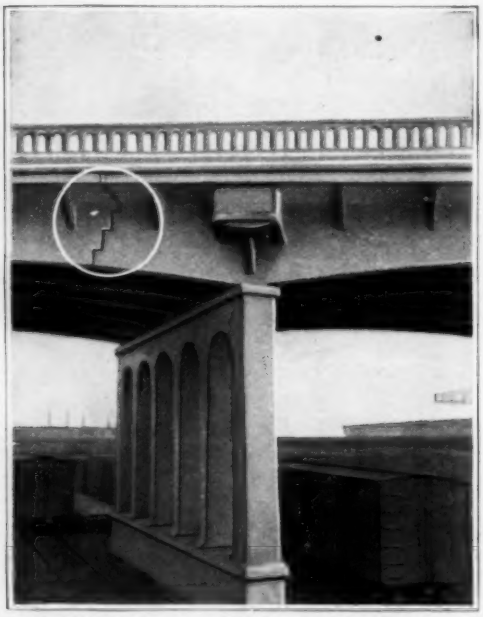


Boat Building is Taught at a Number of Schools along the Coast

Operating a Linotype Machine at One of the Schools Which Offer Vocational-Training Courses

CONCRETE BRIDGE IS BUILT ALONG NEW LINES

Unusual methods of construction featured the erection of a concrete bridge at Portland, Me., recently.



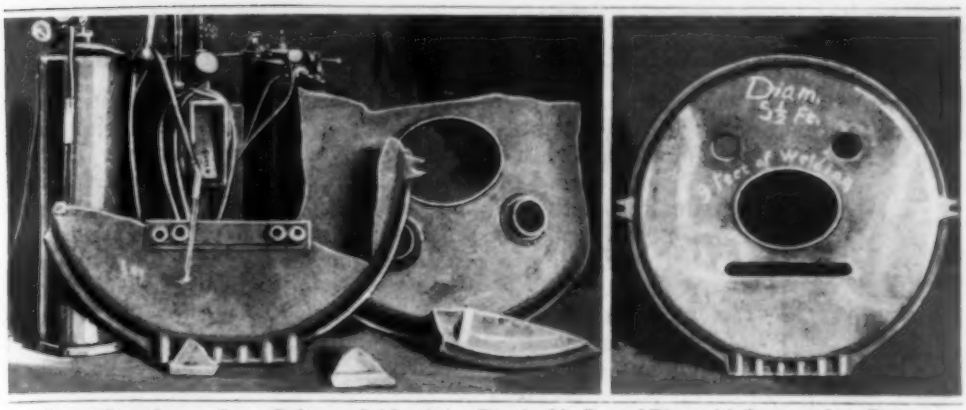
A Portland, Maine, Bridge is Built with Unusual Manholes and Method of Allowing for Concrete Expansion with Changes in Temperature

Chief among these was the manner of installing manholes for the conduit lines which crossed the bridge. Unlike the more usual method of molding a compartment in the solid concrete of a pier for manhole purposes, the designers of this viaduct provided for the separate molding of these conveniences. After becoming fully hardened in a form on the ground, they were hoisted to position just beneath the future sidewalk of the bridge and hooked in with the main reinforcements. Rods left protruding from the manhole sides permitted this hooking-up process, and after concrete had been poured in the main bridge beams, the whole affair became firmly locked together. Manholes so installed did not detract from the architectural appearance of the bridge, and at the same time afforded a cheap and effective solution of the problem of building these features. The brackets supporting the sidewalk were also molded and put in place on the bridge in the same manner. Expansion and contraction of the long beams through temperature changes was provided for by making alternate spans of the suspended type. The huge slab of concrete forming the suspended section was in each case supported by overhangs, or cantilevers, from the solid spans on each side. A sort of "stair-step" joint at the junction of suspended and supporting spans allowed free expansion at all times.

HEADLIGHT IS IMPROVISED FOR USE ON BABY CAB

Both novel and practical features are embodied in an electric headlight that has been devised for a baby carriage by an Illinois mechanic. The device consists of a lamp, reflector, and lens of a large flash light, fixed to a supporting bracket hinged on the top of a perambulator. The bulb is supplied with current by two dry cells carried in the bottom of the vehicle. It throws a shaft of light for a considerable distance so that a clear view of a sidewalk or crossing is given at night on poorly lighted streets. An additional function served by the lamp is that it pacifies the baby who occupies the cab. The child showed aversion against riding in the dark, and this peculiarity had much to do with the construction of the headlight.

Ordinary Flash Light Reconstructed to Serve as a Headlight for a Baby Carriage



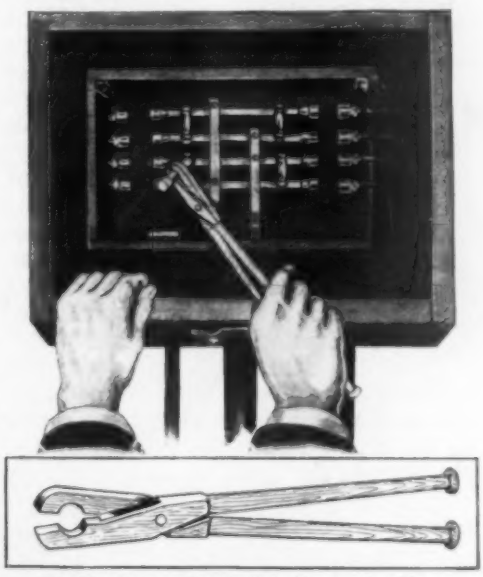
Large Transformer Cover Before and After being Repaired in Record Time with Oxyacetylene Flame

OXYACETYLENE WELDS HUGE TRANSFORMER COVER

Through accident a transformer cover was broken into numerous pieces in a Utah city recently. Because of the difficulty of readily securing a duplicate lid, it was resolved to weld the broken parts together with an oxyacetylene flame. The cover was 5½ ft. in diameter and the welds totaled nearly nine feet in length. The metal varied in thickness from ¾ in. to 1⅛ in. Large and unwieldy as the work was, the completely repaired cover was returned to its owner within 24 hours after receipt. The interior of the usual transformer is filled with an insulating oil which it is highly important to keep from contact with moisture or water in any form. The latter will quickly destroy the insulating properties of oil, hence the solicitude usually evidenced for keeping transformers tightly covered and in good repair.

WOODEN TONGS PERMIT SAFE HANDLING OF FUSES

Around switchboards and cut-out boxes there is frequent need for pulling out and inserting fuses, due to the fact that they burn out occasionally when overloaded. To replace fuses with the fingers is sometimes a difficult task, because of the grip with which they are held by the clamping springs. Then, too, the proximity of other fuses and bare metallic parts frequently gives an operator an unpleasant electric shock while attempting to make the change. To enable quick and safe removal of fuses, a manufacturer has recently gotten out a pair of tongs made of rock-elm wood, and neatly finished with an insulating varnish. The wood, being an insulator, of course prevents shocking the operator

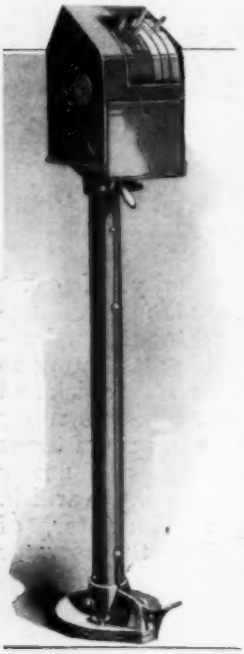


Wooden Tongs Permit Safe Removal of Fuses

as well as short-circuiting any metal parts with which it may come in contact.

MACHINE OFFERS SOLUTION OF TRANSFER PROBLEMS

The use and abuse of transfers is a subject of much concern to street-railway managements. Yet in spite of this a simple way of dealing with the problem has been slow in appearing. Railway engineers have lately become considerably interested in a machine put out by a middle-western firm which promises to solve the principal difficulties heretofore met with.



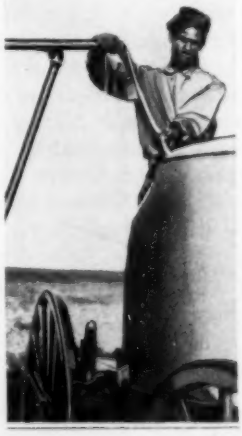
The new machine stands on a pedestal and conveniently near the conductor as he collects fares. Upon a passenger's naming the line to which he later wishes to change, the conductor presses down a lever at the top of the machine corresponding to that line, presses his foot on a pedal, and a printed transfer is automatically presented to the passenger immediately. The complete date, the hour, the locality, the conductor's number, and the name of the line transferred to, are all printed in the one stroke of the pedal. Blank transfers consist of nothing more than a bare roll of paper put into the machine at the beginning of the run. Thus the cost of printing the slips in the usual manner is wholly eliminated. From 60 to 70 transfers per minute can easily be issued on the machine, thus making for speed. From the fact that the machine automatically numbers each consecutive transfer, a check on the conductor and a record of his daily output of slips are made possible.

CUBA WANTS DESIGNS FOR "MAINE" MEMORIAL

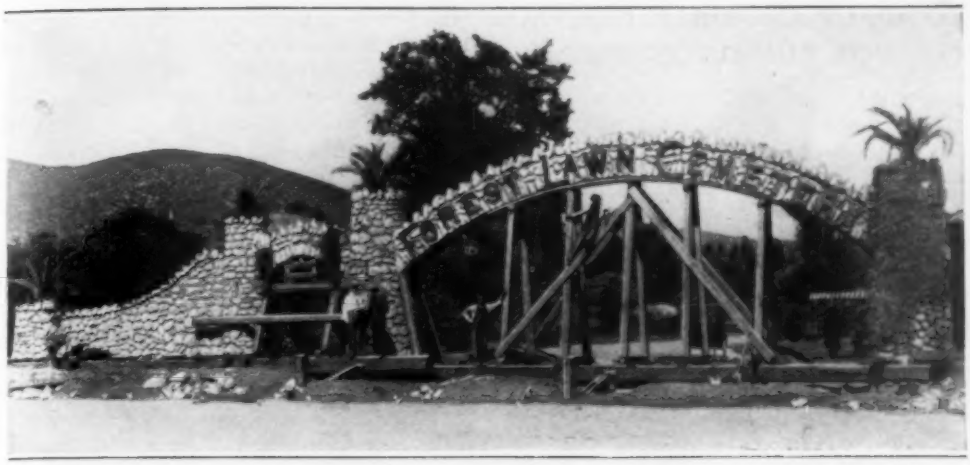
An international competition for plans for a "Maine" memorial to be erected overlooking Havana Harbor, is announced by the Cuban Maine Memorial Commission. The total cost of the structure, not including that of placing, may not exceed $33,000. Two prizes will be awarded, one of $1,500 and the other of $500, for the two best plans. The relics of the battleship which were presented by the United States to the Cuban government, namely, a turret, two cannon, an anchor, and a chain, should be the motif of the monument. It will stand in a triangular piece of ground not 400 feet from the water front, where it will be passed by thousands of persons daily and will be a conspicuous landmark for all ships entering the harbor.

HINDUS USE INNER TUBES FOR WATER SPOUTS

Inner tubes of no further service for automobile tires have been given a new usefulness on a southwestern ranch. Here the Hindus, now commonly employed as ranch hands in the region, have taken to using old inner tubes as water spouts for the filling of tank wagons. In such service the useful days of the tires are materially extended. Railroads have used a cotton hose for the same purpose in filling engine tanks.



¶ The tendency for bigger battle cruisers is illustrated by a recent request for longer drafting tables in the Bureau of Construction of the Navy Department.



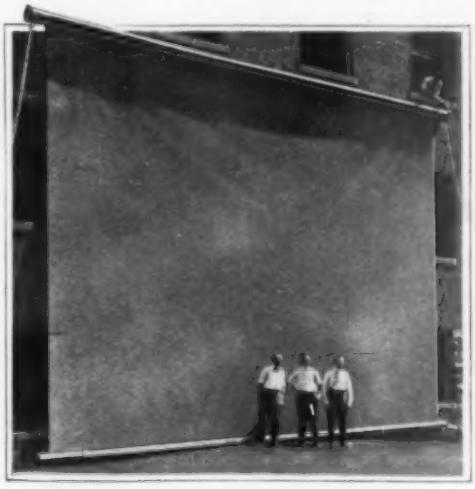
Cobblestone Archway Having a Span of 38 Feet was Moved on Rollers without Cracking

MOVES COBBLESTONE ARCH SEVERAL FEET INTACT

Owing to a change in street arrangement it was necessary a short time ago either to tear down or move an elaborate cobblestone archway over the entrance to a cemetery in a California city. Inasmuch as the new entrance to the grounds was only a few feet away in the new arrangement, it was decided to move rather than rebuild the structure. The arch itself spanned a distance of 38 ft. and the entire affair, including abutments, measured 105 ft. in length. No reinforcement of any kind had been used in the original building of the arch, making it especially difficult to move without cracking. However, the task was accomplished without mishap. Especial care was taken to adequately support the weakest parts of the structure in transit. The moving required 10 days as against a probable two months necessary to tear down and rebuild the structure, had that method been tried.

LARGE SHADE SERVES AS PICTURE SCREEN

What is claimed to be the largest roller shade ever constructed was recently completed for a high school at Greenfield, Ohio. The screen, which will be used as a moving-picture background, is built along the lines of the ordinary roller shade. It is 27 ft. wide and 22 ft. deep and made of the same fabric used in ordinary shade construction. The fact that the screen may readily be rolled up and put out of the way is a convenient feature in school service. Also when rolled up, discoloration from dust or finger marks is prevented.

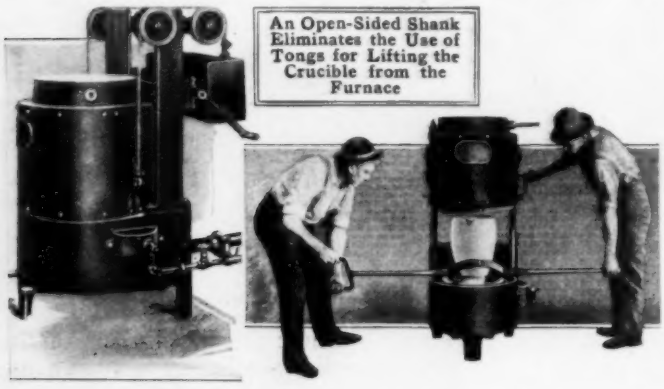


Large Shade is Used as Moving-Picture Screen in Ohio School

¶One counter in an eastern five and ten-cent store is now devoted exclusively to the sale of standardized automobile parts.

COMPACT CRUCIBLE FURNACE FOR BRASS FOUNDRY

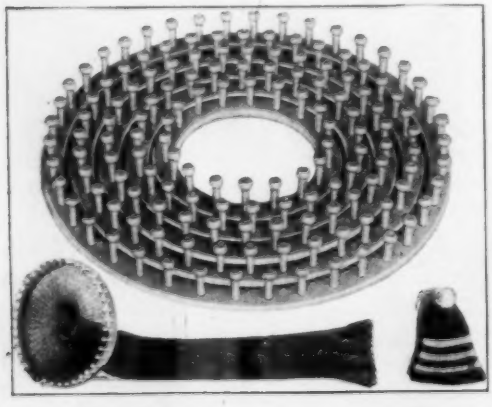
Compactness and ease of manipulation are two of the features which have been incorporated in a crucible furnace that has been designed to use either oil or gas as fuel. It is especially adapted for brass and bronze foundries and permits molten metal to be poured directly from the crucible in which it is melted. The type designed to receive a No. 60 crucible is 34 in. in height and occupies a floor space of 2 ft. by 4 ft. The crucible chamber is arranged with a counterweight so that it may be raised or lowered easily by means of a rack and pinion. By lifting this the crucible may be removed easily with the aid of an open-sided shank. A blower capable of delivering approximately 250 cubic feet of air a minute at a pressure of from 10 to 16 ounces is used with it. The flame enters the combustion chamber at a tangent and fills the space surrounding the crucible. The apparatus is convenient when quick heat is needed for rush work.



An Open-Sided Shank Eliminates the Use of Tongs for Lifting the Crucible from the Furnace

KNITTING HOOPS ARE MADE IN NOVEL FORM

Mufflers, stocking caps, shawls, and many similar articles of apparel, may be made quite easily with the assistance of knitting rings of a simple type which have been introduced of late. The outfit consists of six hoops of graduated sizes fitted with a series of pegs. Sweaters, scarfs, and other heavy things, are made on the largest of the rings, while doll clothes and tiny articles are knitted on the smallest frame. In using any one of the rings, a skein of yarn is first wound into a ball, an end tied loosely about one of the pegs and the material then woven in and out between the other members until the starting point is again reached. The second time around, the yarn is entwined on the opposite sides of the pegs. When this is completed a crochet hook is employed to cross one of the strands over the working strand and slip it about each peg in succession. This process is continued until the desired length in one color is reached, when other yarn is worked in to produce a stripe or band. To prevent it from unraveling, the work is crocheted off the hoop when it is completed.

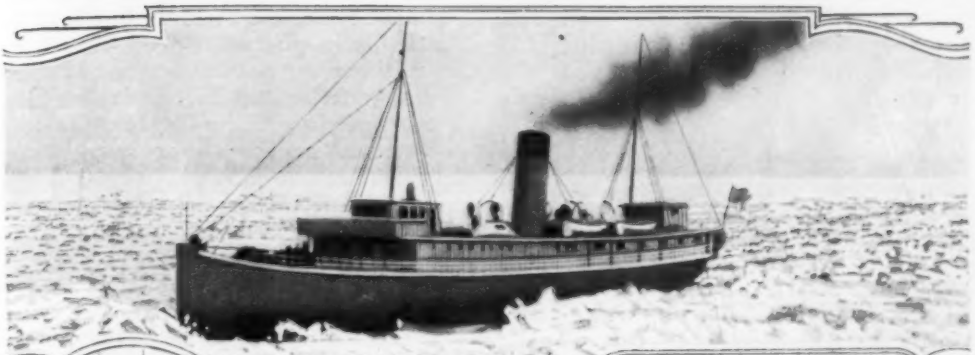


The Knitting Frames are Substantially Made and Finished in White Enamel or Natural Wood Color

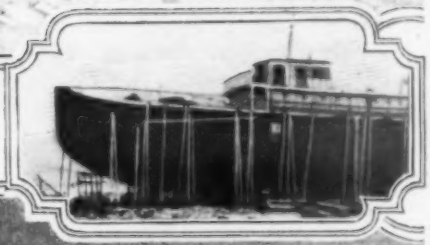
¶With the evident intention of keeping pace with the times, a band of 20 gypsies now traveling in the middle West are using automobiles as a means of transportation.

THE KEY TO RUSSIA'S DOOR

By LEROY KENNETH



Above: The Canadian Ice Crusher "Minto" is Pushing through the Floes in the Northumberland Straits. The Shape of Its Bow is Shown at the Right



Here the "Earl Grey" is Shown Following a Lane Crushed through the Ice by the "Minto"

The Sharp-Prowed Ice Breaker "Earl Grey" Stuck in a Heavy Field in Northern Waters

THE success or the failure of the "Minto," the ice crusher Canada has sent to clear the way at Archangel, means victory or disaster to the Russian army.

Russia is dependent on the outside world for her military supplies. Her Baltic ports are closed by the German navy. Her Black Sea ports can only be reached through the Dardanelles, and the allies have failed to force that passage. Supplies through Vladivostok must cross Siberia on a railroad lacking in rolling stock, and not completely double-tracked. Archangel is

her only remaining door to the world. The "Minto" is keeping that door open.

Last winter, Canada's new ice breaker, the "Earl Grey," with the "New Bruce" and the "Lintrose" from Newfoundland, and Russia's "Merrimac"—all ice breakers—tried to make Archangel a winter port. And last winter the Galician campaign of the Russian army astonished the world—until its ammunition gave out; then it was forced to retreat and its defeat became nearly a disaster. The failure of the Russian army to hold the territory it won was the direct result of the failure of the ice fleet at Archangel.

When Russia realized the allies might not succeed at the Dardanelles, she placed immense orders for rails and rolling stock in this country; but the slide in our own Panama Canal held the boats carrying the equipment in the Atlantic and forced them to choose between making the long trip around Africa or braving the submarines in the Mediterranean. The delay allowed the early Siberian winter to set in. Vladivostok is crowded with supplies, and the railroad service to Europe is still inadequate.

Russia must beat the ice at Archangel or face another munition famine. Jack Frost has always been pictured as her ally, but now he is fighting on the other side. He is trying to seal up Russia's only door. The "Minto" is keeping the door open.

The "Kyle," the "Bellaventure," the "Bonaventure," the "Biothic," and the "Misconopic" have been added to the fleet that failed last winter; they are all ice breakers; but the "Minto" is not an ice breaker: it is an ice crusher. The ice breakers have sharp prows that cleave through the ice, a principle that works rapidly and well—until the ice grows thicker than the draft of the ship, then the ice breaker is helpless.

The "Minto" has no keel forward of midship; instead, its bottom slants away abruptly at the water line. In the water it looks like a tramp down at the stern; but its bow and bottom are heavily plated, and its hull reinforced. When it rams an ice field at full speed, it climbs onto the floe until its weight crushes through.

In the shallow waters of the St. Lawrence Gulf, where the fresh-water ice from the river sometimes banks until it rests on the bottom, the ice breaker is more useful, but in the Hudson Bay and the arctic the ice crusher is still king. The White Sea is deep at Archangel. The "Minto" is a willing boat, and brave, and the fate of Russia depends on its success.

Through forty miles of heavy ice the fleet must keep a channel. Night and day the ice breakers patrol the course up near the arctic circle. When they meet ice they cannot cut, the wireless calls the blunt-nosed "Minto," it bucks a lead through, and Russia's door to the world is kept open.

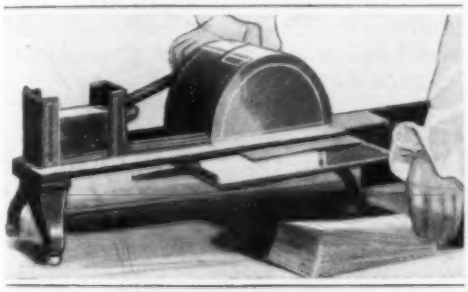
EUROPE USING SUBSTITUTES FOR ABSORBENT COTTON

Owing to the unprecedented demand for absorbent cotton caused by the war, with the resulting high prices, substitutes for this material are being made and sold on an extensive scale in a number of European countries. In Germany, particularly, the price of cotton is extremely high and is getting higher, since that country is entirely shut off from the American market. The substitutes produced in that country are much cheaper than cotton, but their sale has been somewhat retarded by the fact that they do not possess all the good qualities of cotton. One substitute having a big sale in Berlin is made of pure pine cellulose, and is used chiefly to stop bleeding. It is claimed that it absorbs blood much better than cotton, but that it is not as good as a dressing for a wound. In Sweden a cellulose wadding for dressing wounds is being made from chemical-wool pulp. This material is prepared in thin sheets like tissue paper, but is crimped. Bog moss, which has the advantage of requiring little preparation, is being extensively used in London as a surgical dressing. This moss is permeated with minute tubes which make it one of the best absorbent materials known. The

same material was on the market in Germany before the outbreak of the war, and is presumably used in that country at the present time.

ADDRESSING MACHINE MADE FOR SMALL OFFICES

For the convenience of business houses, clubs, and other institutions which have mailing lists of moderate size, a compact, fast addressing machine has been developed. It is quite portable, may be used on a desk or table and is operated by hand. Its capacity amounts to from 1,200 to 1,800 envelopes or post cards an hour. One of its features is the character of the stencils used. These are made of a specially prepared silk fiber, which contains no wax, and are cut on a standard typewriter. Any stenographer can perform the work. A small metal carrier



Hand-Operated Addressing Machine Capable of Printing Approximately 1,800 Envelopes an Hour

is clamped on the platen to hold the individual cards as they are cut. Each may be used many times without showing wear. When they are placed in the addressing machine they are carried forward to the printing position mechanically, while the envelopes, fed into one end of the device, are shot through, addressed, and discharged by turning a crank.

WINDOW CURTAINS OPERATED BY ELECTRIC MOTORS

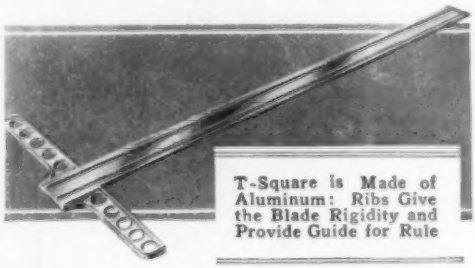
Electric motors controlled from the lecture platform are used to operate the window curtains in a lecture hall at the University of Michigan, where as many as eight lectures requiring

Window Curtains in a University Lecture Hall Operated by Electric Motors

a darkened room are given in one day. The curtain rollers are much like the ordinary rollers with the ratchet and pawl omitted, the cords being depended on to prevent the curtains from rolling up. These cords run through openings in the window sill and are attached to electrically driven drums. One motor operates several curtains. The control mechanism for the motors is installed on the platform in the cabinet with the lamp switches. The friction in the pulleys is sufficient to prevent the curtains from being rolled up when the motor is deënergized.

ALUMINUM T-SQUARE TO SUPPLANT WOOD

Aluminum as a material for T-squares is rather unusual, yet an eastern architect has constructed one of this material, and he claims the new



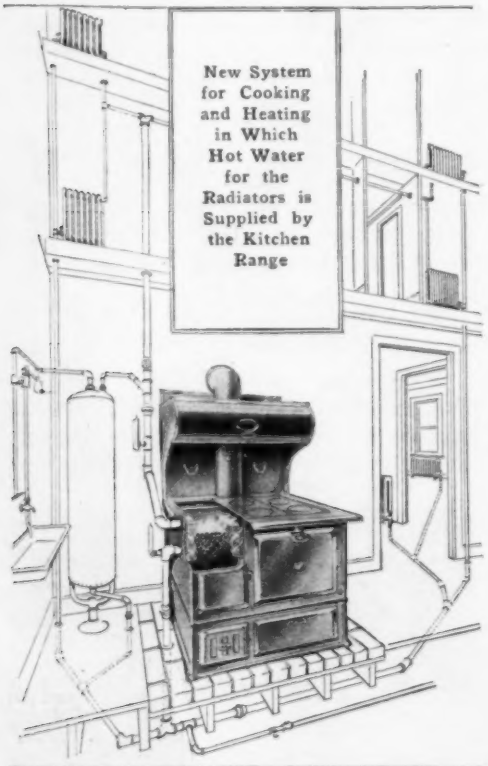
T-Square is Made of Aluminum: Ribs Give the Blade Rigidity and Provide Guide for Rule

type has several advantages over the ordinary wooden square. The blade on this square is stamped from sheet aluminum, and has two ribs running

down its length which not only give the blade rigidity, but provide a track along which a triangular rule may be run. The head is cast instead of stamped, and is suitably recessed for reception of the blade. Among the advantages claimed for the new square are its nonwarping features, and the fact that it will not smut nor blacken the paper on which it works.

HOT-WATER HEAT SUPPLIED BY KITCHEN RANGE

The latest plan for house heating is a system in which hot water for the radiators is supplied by the kitchen range, which is especially made for the purpose and is equipped with an unusually large fire box. The piping system is like that of an ordinary hot-water heating plant. Entirely surrounding the fire box is a water back equipped with 22 tubular water passages, and these passages are so arranged that the hot gases from the fire come in contact with them on every side. In addition to this, the hot gases are made to heat the oven, the idea being to combine an efficient heating and cooking plant in one stove. By means of a connection with one of the main pipes, hot water is supplied to an ordinary hot-water tank and through this to the kitchen sink. In addition to the marked economy in fuel that is claimed for this system, it evidently has the advantage of being especially suitable for installation in flats and in cottages where only limited basement space is available.



New System for Cooking and Heating in Which Hot Water for the Radiators is Supplied by the Kitchen Range

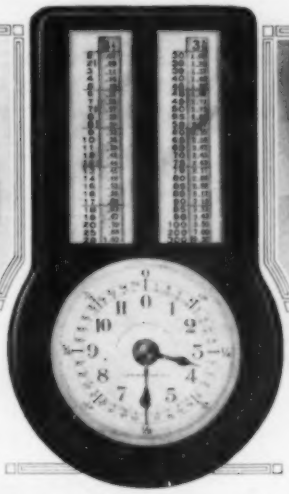
AMERICAN "GIBRALTAR" IN PACIFIC OCEAN

Oahu, an island in the Hawaiian group, has been called America's Gibraltar because it is the only land available for a naval base in the Pacific within a circle whose center is this island and whose radius is equal to the distance from Hawaii to San Francisco. In the past decade the government has expended approximately $13,000,000 in improving this rocky island as a naval base. Of this sum $10,000,000 was used in developing a ship-repairing plant. The fortifications, including fire-control apparatus, submarine torpedo system, powerful wireless station, searchlights for watching mine fields at night, and batteries of howitzers, some of which are located on a ridge of mountains from 1,500 to 3,000 feet high, all combine to make this a strategic point ranking in strength and importance with Gibraltar.

MEASURING AND COMPUTING DEVICE FOR DRY GOODS

As a means of preventing losses due to overmeasurement of piece goods and miscalculation of prices, a simple measuring and computing machine has been developed for use by clerks in dry-goods stores. It is a small device that may be attached to a rail at the rear of a counter and turned down out of sight when it is

Overmeasurement and Miscalculation of Prices are Guarded Against by Employing the Device Which is Here being Used with Piece Goods



Dial and Price-Computing Scales on the Top Surface of the Machine: The Rollers Automatically Adjust Themselves to Receive Goods of Different Thicknesses

The Apparatus has Also been Adapted to Meet the Needs of the Ribbon Department: The Material is Wound from One Roll onto Another as Sold

not in use. It is operated by drawing the selvage of a piece of cloth between two rollers, which adjust themselves to receive material of various thicknesses. When this is done the yardage is measured and the retail price of the specific length indicated simultaneously by a dial and two rectangular scales. The machine may be operated both backward and forward, so that in case a customer should decide to purchase two yards of cloth after three yards have been measured, it would only be necessary to draw the goods back until the indicator hands point to "two yards." The machine has also been adapted for the measuring of ribbon.

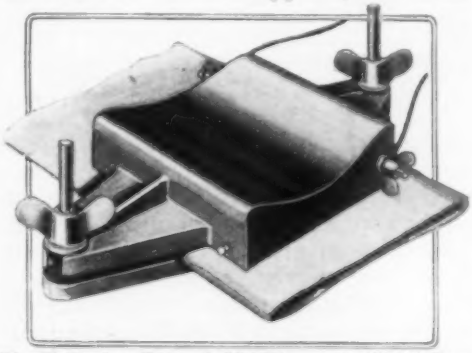
ALLIES PLAN STEEL HOUSES FOR DEVASTATED AREA

The construction of steel houses to take the place of the thousands of dwellings destroyed in the battle territory in Belgium and northern France has been the subject of negotiations between the allies' governments and certain American manufacturers. Estimates as to the cost of lumber showed that if large numbers of houses of uniform size and style could be made, steel would be a cheaper and more satisfactory material than wood. It is not anticipated that the structures would be occupied permanently, yet they must be sufficiently durable to last an indefinite period, if needed. The proposed steel houses are 12 ft. by 24 ft. in ground dimensions, and 9 ft. high. It is planned to make them available for soldiers also.

¶A large Chicago corporation has installed a shooting gallery as part of its recreation equipment for employes.

NEW ELECTRIC VULCANIZER FOR AUTOMOBILE TIRES

An electric vulcanizer of a new type for repairing automobile tires is equipped with a thermostatic cut-off which shuts off the current when the proper degree of heat for vulcanizing the rubber has been applied, and thus prevents the burning or overcuring of the tire. The vulcanizer is a simple and compact device, weighs less than

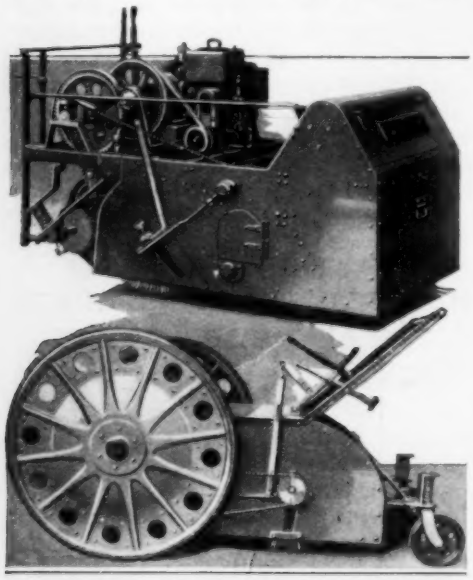


Tire Vulcanizer Controlled by Thermostat Which Cuts Off Current When Proper Degree of Heat is Reached

two pounds, and is operated by a 6-volt storage battery such as practically all automobiles are now equipped with. All that is necessary is to connect it with the battery, secure it to the tube or casing, and turn on the current by means of a push button. After this it needs no attention, as the current is shut off automatically at the proper time.

HAND AND POWER SWEEPERS FOR INDUSTRIAL PLANTS

For cleaning industrial plants, warehouses, and similar institutions in which large floor areas require attention, two fairly compact sweepers have been invented. One of these is operated by power, while the other is pushed by hand. In each instance the broom is so arranged that it adjusts itself to uneven surfaces, while a counterbalance enables its pressure to be varied according to conditions encountered and also makes compensation for the wear of the fiber.



The Power-Driven Sweeper is Equipped with a Three-Horsepower Engine and Operates at a Low Cost. A Pressure of 26 Pounds is Sufficient to Work the Hand Machine on Ordinary Floors

In the power-driven machine the sweepings are brushed into a pan a few inches above the floor and delivered into a conveyor which carries the material into a bin of 2 cu. ft. capacity. This apparatus, which is three-wheeled, is provided with a 3-hp. gas engine, is slightly more than five feet in length, and weighs 700 lb. Normally it is capable of covering 27,000 sq. ft. of floor space in an hour.

The hand sweeper weighs 300 lb., is carried on two rubber-tired steel wheels and a pair of casters, and is propelled at a rate of two miles an hour by exerting a pressure of 26 lb. upon its handlebar. At this speed it is able to sweep about 20,000 sq. ft. of surface in an hour. The dirt caught in its sweeper pan is dumped into a bin by means of a lever.

Both devices can be operated within about four inches of a wall or curbing and used for sweeping driveways, loading platforms, and other surfaces of like character.

ODD DISPUTE ABOUT FULL-CREW LAW

A technical legal question, which is of very real interest to trainmen and the railroads in Pennsylvania, has been raised as to whether a combination coach and baggage car, under the Pennsylvania full-crew law, requires one more member on the crew because it is a car that is performing two functions. The law says that every train consisting of three passenger coaches and one baggage coach shall carry an engineman, a fireman, a conductor, a baggageman, and a flagman. The contention is now made that when a four-car train includes a combination baggage and passenger car there should be six in the crew, for that is the number required when a train contains four passenger coaches and a baggage car.

¶Many persons persist in applying five-cent stamps to letters addressed to Hawaii, or other of our island possessions, apparently ignorant of the fact that an ordinary letter will be carried for two cents.

CALIFORNIA SUN PROVES EFFICIENT WOOL DRIER

Showing the Great Masses of Wool Lying on the Floor of a California Drying Plant: Natural Heat Does the Drying in Place of Steam. In the Other View the Plant Exterior is Shown

In southern California the sun may be relied upon to shine approximately 350 days out of every 365. Moving-picture concerns have made substantial use of this fact in the taking of films. Another industry which is finding the California sun an asset is that of drying wool. The usual way to do this work is with steam, but here, because of the peculiar climate, an ancient system has been revived and found the better.

A solar drying plant, three stories in height, was recently erected. The lower floors serve for storing and sorting, while on the top floor the actual drying processes are carried out. A glass roof admits the sunlight freely, while screened sides allow ready circulation of air. On the floor are heaps of raw wool which are stirred constantly. The material comes from a scouring plant near by, where natural oils and greases have been removed. Currents of air in large pipes transport the wool from place to place. It is maintained that wool dried by sunlight has superior qualities over that deprived of moisture by steam or other artificial processes.

STREET RAILWAY ERECTS WAITING PLATFORMS

An innovation lately appearing along the street-railway tracks of Los Angeles consists of concrete waiting platforms of new and unusual design. Realizing that on some of the broad avenues a person waiting for a car is likely to be run over by speeding automobiles, or may possibly get too near the tracks for safety, the street railway decided to build these special places at each corner for the accommodation and protection of intending patrons. The new stations consist merely of a cement platform a few inches above ground, and separated from street traffic by a curb. The track side is sufficiently far from the rails to prevent passing cars from coming in contact with anything within the confines of the platform. Aside from thus isolating and protecting patrons, the new stations have the further advantage of making it perfectly evident where cars start and stop, a convenience greatly appreciated by strangers in the city.

Concrete Waiting Platforms Protect Street-Railway Patrons from Passing Vehicle Traffic

CONTRASTING BURIAL LOTS USED FOR ADVERTISING

This Contrast between a Well-Kept Burial Lot and One That is Neglected is Used by a Monument Company for Advertising Its Business

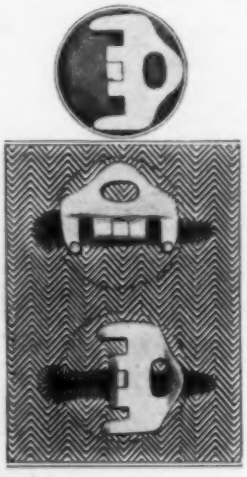
The contrast between a well-kept burial lot and one that is neglected is used effectively by a monument company in Shreveport, La., for advertising its business. Near the sidewalk, where every passer-by can see it, is a neatly kept plot of ground in which are several headstones. On the iron fence that incloses this lot is the sign "Lovingly Remembered." Near this is another lot that is overgrown with a tangle of grass and weeds and is inclosed by a tumble-down wooden fence on which is the sign "Sadly Forgotten." Obviously the contrasting plots attract attention.

FLEET SUBMARINES PRESENT DIFFICULT DESIGN PROBLEM

Naval engineers have found themselves in a rather difficult predicament due to recent congressional action. In a bill passed some time ago by that body provision was made for two fleet submarines that should have a surface speed of 28 miles an hour. Speeds above 22½ miles for submarines have been before unheard of. To get such a rate of travel, the engineers believe it will be necessary to use steam as motive power, with oil-fired boilers as a source of supply. Thus, upon submerging, the fires will be turned out, that the oxygen within the boat may not be used up. Radical changes in hull design will likewise have to be made in order to house the new type of motive power. The engines will be separated from the rest of the boat by heavy bulkheads.

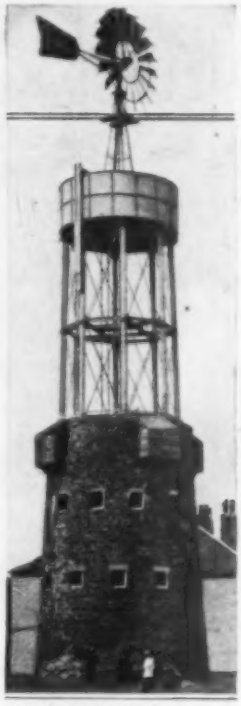
NEW ATTACHING DEVICE FOR BUTTONS

For attaching buttons in such a way that they can be easily removed and replaced, a new device designed to take the place of the screw button ordinarily used for this purpose has been invented and placed on the market. This device consists simply of a flat plate that is hinged to the shank of the button so that it can be passed through a buttonhole and laid flat on the opposite side of the cloth. On each of the two corners of the plate adjacent to the hinge is a blunt prong. The plate is inserted and turned across the buttonhole, then pressed down so that the prongs bear against the cloth.



OLD FORT NOW SERVES AS WATER TOWER

Among the picturesque villages of the Channel Islands off the English coast evidences are still visible of other troubled times when Britain was on a war footing, even as today. Dotting the countryside in many places are stolid, black, forbidding old structures known as martello towers. On top of these stubby edifices, lumbering old cannon used to be mounted, and pointed toward France, then England's worst enemy.



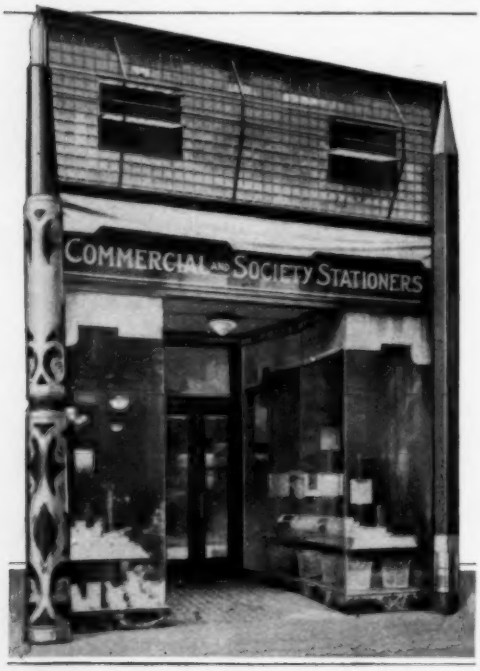
COPYRIGHT, E. O. CATFORD

In the peaceful days later on, however, the old forts were converted to various utilitarian uses. One of them is now serving as a water tower for a village street-sprinkling system, a use curiously in contrast to its one-time martial service. Surmounting the steel columns and water tank, which rise high above the old stone walls, is a chipper iron windmill of the kind familiar to every American farmer. Through the aid of brisk channel winds, this mill manages to keep the tank filled.

GIANT PENCIL AND PEN SERVE AS PILLARS

In designing the front of a stationery store recently erected, 12-ft. reproductions of a pencil and fountain pen were placed in vertical positions, like pillars, at the opposite sides of the building.

The former of these is 7 in. and the latter 9 in. in diameter. Each closely resembles its prototype, except in size. Together they form very novel sign-



The Great Pencil and Pen Serve as Novel Signposts for This Stationery Store

posts for the shop, and have attracted much local notice. The barrel and cap of the pen are decorated with a standard design which gives much of the appearance of silver inlay. The details of the pencil have been worked out so well that by placing a sheet of paper over part of the accompanying photograph, so that only the former pillar is shown, it appears to be an ordinary pencil.

OIL WASTE RECEIVES SCIENTIFIC STUDY

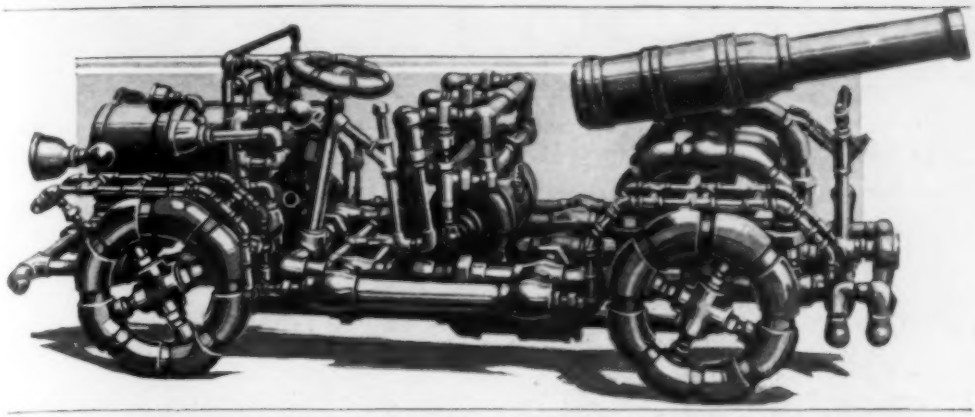
Persons in charge of machinery have often been troubled with oil creeping over the outer surface of a bearing, the cause of this not always being exactly evident. The subject has received recent study by an English engineer. The fact that oil spreads even when the bearing is at ordinary temperatures is credited to the fact that air is drawn into the liquid by the rotation of the shaft and by rapid movement in circulating pipes. As a result minute bubbles fill the oil to saturation. As these come to the surface, they burst, creating a fine spray. It is the spray which settles on the bearing exterior. To remedy this condition, it is suggested that return pipes from bearings be made large enough to carry off surplus oil, bubbles and all. Or the installation of a vent pipe which opens out at a higher level than the oil-supply tank will cure the trouble.

FARMER USES TANK HOUSE AS TEMPORARY RESIDENCE

Being without sufficient funds to build a farmhouse of the style he desired, and needing a water supply badly, a western farmer decided to build himself a structure that would answer both purposes. The result was a towerlike building topped by a steel tank to give pressure to the water-supply system. The interior of the tower beneath the tank was divided into rooms, and in these the

Water Tower at the Rear of a Lot Serves as Temporary Farm Residence

farmer lived until enough funds were accumulated to build a house of more satisfactory character.



Military Automobile of Miniature Size Built Entirely of Odd Pipe Fittings

PIPE FITTINGS ASSEMBLED INTO WARLIKE AUTO

A ferocious-appearing, though miniature, automobile of military type was recently constructed by an employe of an eastern manufacturing plant during spare moments. The machine, in spite of the huge cannon mounted above the rear wheels, is quite harmless, since the only materials used in its construction were a miscellaneous aggregation of pipe fittings. Practically every kind of fitting known to the trade has a place somewhere in the odd machine. Such attention was given to careful assembling that the many parts fit together harmoniously and give the machine an appearance complete as to details. The model is 6 ft. long, a little over 2 ft. wide, and weighs 700 lb. In constructing the odd vehicle 1,129 separate pieces were used.

LIGHT-WEIGHT RESPIRATOR FOR FACTORY WORKERS

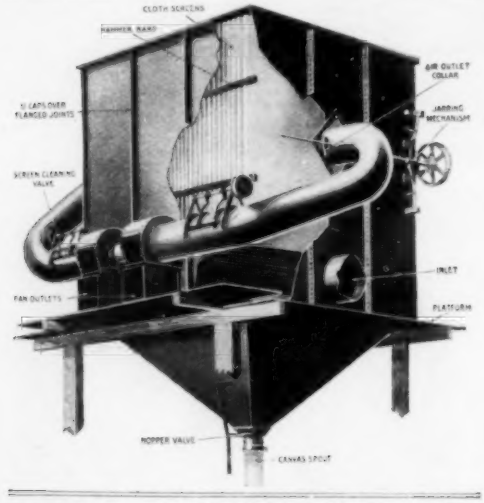
Many of the so-called occupational diseases are caused by the inhalation of dust, and to obviate this condition a respirator, made with a very fine screening of wire supplemented with other filtering mediums, has been introduced. Although it is claimed to be capable of blocking the passage of the finest dust particles, it does not hamper normal breathing. It is considerably smaller in size than some other devices of similar character which are now in use, and fits snugly over the nose and mouth. It is held in this position by an elastic band that passes about the base of the head immediately below the ears. The body of the respirator is lined and covered with soft cloth. There is no metal or leather about it to touch or chafe the skin, while it is also exceedingly light in weight so that the user experiences no discomfort in wearing

Wire Screening of Fine Mesh Is One of the Filtering Mediums Employed in This Respirator, Which is Worn to Safeguard against the Inhalation of Dust in Factories, the Character of Some of Which is Shown, Highly Magnified, in the Two Inserts

it. A saturating pad is fastened over the front part of the device when it is employed in shops filled with noxious fumes.

DUST ARRESTER PURIFIES FACTORY AIR

Designed to rid factory air of its burden of dust, an air purifier has lately been marketed. The invention consists



Machine Removes Emery Dust from Factory Air

of a series of cloth screens placed one behind the other and inclosed in a sheet-steel box provided with suitable entry ports and delivery points for the air. Dust from around all emery and polishing wheels is gathered in by means of suction fans and conveyed through pipes to the arrester, where the particles are blown against the several screens. These are mechanically agitated, which results not only in the dust being strained out of the air, but causes it to be shaken off the screens into the bottom of the box. A hopper and spout are provided so that the dust may be drawn off and carried away. Manufacturers claim even the dustiest air may be thoroughly cleaned with this machine.

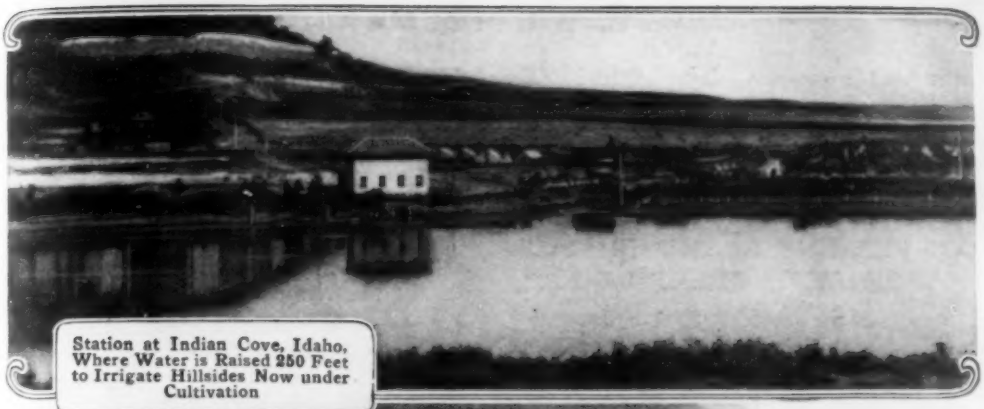
¶An altitude of 11,000 ft. was attained recently by Lieut. R. C. Saufley, U. S. N., in a flying boat, a new record for this type. But it cannot be officially so recorded because the air craft's recording pen ran off the sheet at 9,000 feet.

IDAHO TOWNS ARE LIGHTED AND HEATED ELECTRICALLY

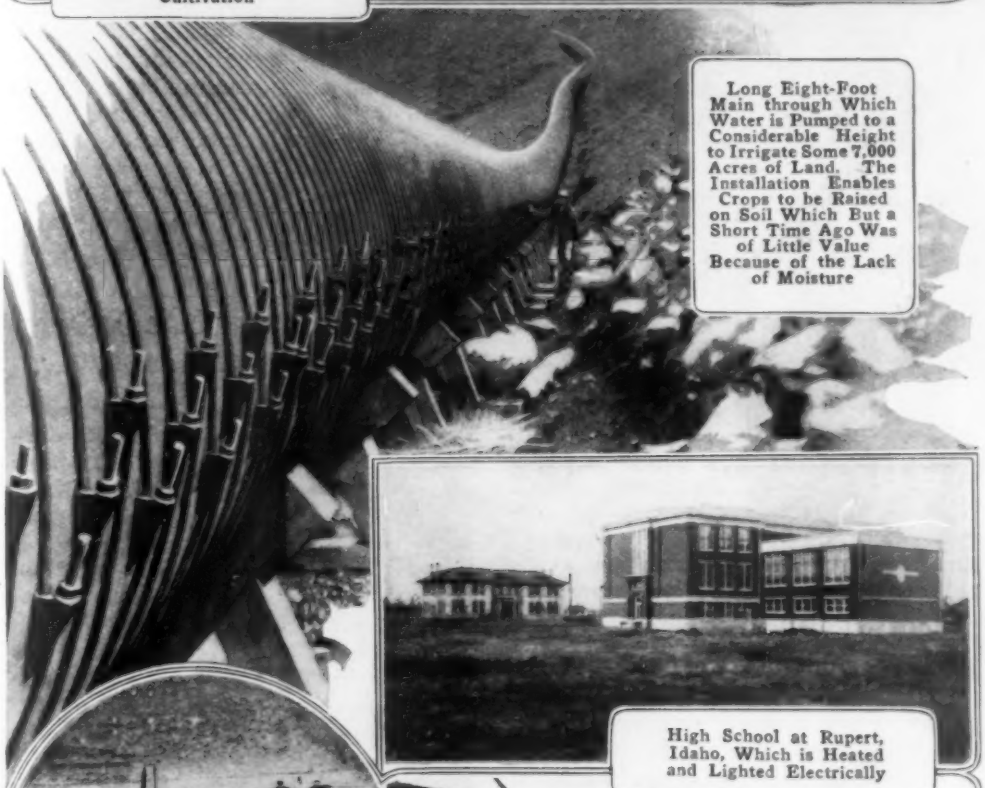
To those who are accustomed to paying the usual city rates for electric energy, the condition which has been brought about in towns and rural districts along the Snake River in Idaho by the Minidoka power and irrigation project is no doubt novel. At Rupert, Idaho, a public high school is heated and lighted electrically, as mentioned at some length in a previous number of this magazine. Altogether, however, the town, which has a population of about 1,000, now uses 1,600 hp. in its homes and stores.

In houses which have cost only a few hundred dollars to erect it is not uncommon to find electric stoves, ranges, lights, washing and sewing machines, and other appliances. The same is likewise true in some other towns and in the country for miles along the river. The farmers not infrequently turn their grindstones and operate separators and other machines by power. And this is all because of the cheapness of hydroelectric energy.

The Minidoka undertaking itself is quite generally understood, but to many the numerous small installations scattered along the river are unknown. For nearly 500 miles through the state there are isolated pumping plants of various capacities. They are supplied with current from the government transmission lines, and in many instances amount to nothing but a small electric pump of probably two horsepower, which raises water 40 or 50 feet to a tract of 15 or more acres. Some of these installations cost no more than $150, and by rendering little patches of land productive, which heretofore have been practically worthless, they are making possible hundreds of new homes. Correspondingly there are large plants supplying water to areas of several thousand acres after lifting it to heights of sometimes more than 200 feet. One of these units is near Payette, and uses 1,150 hp. to irrigate 7,000 acres of land lying at a considerable height above the avail-

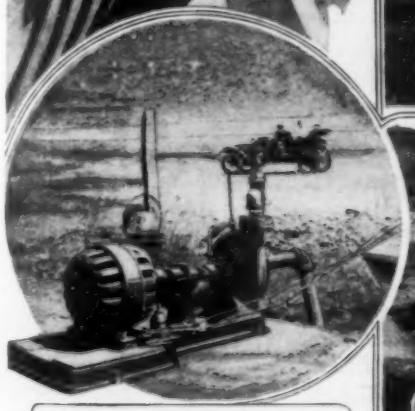


Station at Indian Cove, Idaho, Where Water is Raised 250 Feet to Irrigate Hillsides Now under Cultivation



Long Eight-Foot Main through Which Water is Pumped to a Considerable Height to Irrigate Some 7,000 Acres of Land. The Installation Enables Crops to be Raised on Soil Which But a Short Time Ago Was of Little Value Because of the Lack of Moisture

High School at Rupert, Idaho, Which is Heated and Lighted Electrically



Small Pumping Installation in One of the Isolated Places

This Power Plant, Situated near Payette, Idaho, Pumps Water Which Irrigates Several Thousand Acres of Land, Once Unproductive

able water supply. The state is said to have more than 200 separate electric pumping stations in operation, which together are reclaiming tens of thousands of acres.

CONVENIENT STAND IS MADE FOR DESK TELEPHONE

It is not infrequent that a user of a residence telephone prefers the desk type of instrument but does not have a stand of convenient height, or a suitable desk, on which to accommodate it. Because of this condition a telephone-table outfit has been introduced which may be employed either in a home or office. It consists of a small stand with a stool which may be slipped beneath the former when not in use. Both pieces of furniture are of plain design and available either in golden oak or mission finish. Telephone equipment of either the magneto or central-energy type is supplied with the stand and seat, and the telephone is permanently mounted on the table top, or left unattached. All of the parts, aside from the transmitter and receiver, are concealed under the top of the table.

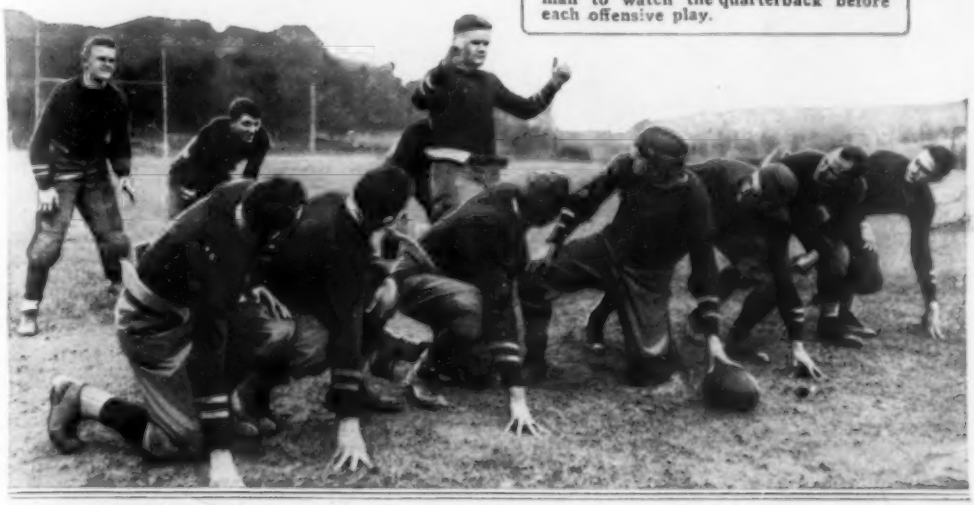
MORE USES FOR LONG WOOL THROUGH NEW PROCESS

A new English patent makes available for general use in manufacture by woolen mills the long, tough fibers of crossbred wool from mutton sheep of New Zealand, which heretofore has only been used advantageously in the machines of the worsted trade. The war, which indirectly has resulted in developing additional uses for many other raw materials, is said to have been an incentive in producing this textile improvement. Heretofore the length and strength of the type of wool referred to has caused serious accidents in the carding machines of the woolen mills. The new invention does not displace any existing machinery or processes, but prepares the wool. No matter how long the fibers, they can be reduced to any desired length, after which they can be blended with other wool, shoddy, cotton, etc. Fabrics woven from it possess a texture that is soft to the touch, instead of harsh and wiry, as in the case of worsted materials. The invention does not produce additional waste but improves the carding, spinning, and weaving, besides increasing the output in all three stages of manufacture, it is said.

TRIPOD CARRIED BENEATH COAT IN HANDY FASHION

As a solution for the annoyance and trouble attendant upon carrying a tripod by hand on picture-taking excursions, a camera enthusiast has devised a simple scheme. A metal tripod is used; one of the kind which folds compactly into a small space. This is strapped close to the shoulder beneath the coat of the carrier, a rubber band holding the legs tightly together. In this position the tripod is out of the way, and the carrier is not put to the trouble of hanging onto it by hand. By always having a tripod along in this fashion, many good pictures are secured which otherwise would be lost for lack of a suitable camera support.

DEAF AND DUMB STUDENTS PLAY FOOTBALL



THE football eleven of a Virginia college for the deaf and dumb during a workout: All signals are given by signs, making it necessary for every man to watch the quarterback before each offensive play.

COPYRIGHT, INTERNATIONAL FILM SERVICE, INC.

NEW BALANCE USES CHAIN INSTEAD OF WEIGHTS

An analytical balance designed to do away with small weights and their handling has been invented. Most existing scales for the use of chemists, and physicists, are of the beam type with a scale pan supported on either side of a central standard. In use, the object to be weighed is placed in one pan and the balancing weights in the other. The process is slow because of the delicacy of the apparatus. The inventor of the new balance has done away with the weight handling, however, by the simple expedient of hanging a chain to the beam on the weight side. The lower end of the chain is supported by a sliding indicator which runs up and down on a graduated scale. By lowering the indicator additional chain is made to hang from the beam, and thus weight is added to that side. Naturally, the reverse operation may be carried out and weight subtracted from the same side. A vernier and finely divided graduations on the vertical scale enable accurate weighing to be done. The contrivance has been pronounced a decided success by experts who have tried it out. All movements of the chain and scale-pan supports may be controlled from without.

Analytical Balance Uses Chain Instead of Scale Weights

RAILROAD COMMANDEERS CAR FOR WATER TANK

An Illinois railroad was in a hurry for a water tower at one of its small-town stations recently. Inasmuch as

Coal Car has been Made to Serve as a Water Tank on an Illinois Railroad

the ordered tower persistently failed to arrive, officials felt it necessary to use emergency means. An empty coal car standing on a side track was seized upon, robbed of its trucks, and elevated to the top of a tower erected alongside the roadbed. The elevating process was carried out with the help of jacks, the ties forming the tower being placed beneath the car as fast as raised. Cracks in the sides and bottom of the improvised tank were calked, and a newly erected pumping station speedily filled the interior with the much-desired water. The odd station has been faithfully supplying passing locomotives ever since.

DOGS CARRY DISEASES TO LIVE STOCK

That dogs are the carriers of such maladies as the foot and mouth disease is the contention of the Department of Agriculture, which has been investigating the question. A dog running across an infected farm may easily carry in the dirt on his feet the most contagious animal diseases. Not only are germs brought to stock in this way but human beings also are liable to contagion. Ringworm, rabies, double-bored tapeworm, and in some instances, through the medium of fleas and ticks, the bubonic plague, have been carried by the faithful family pet. Careful bathing of the dog and careful selection of his food, which should never include viscera not thoroughly boiled, are among the preventive measures suggested.

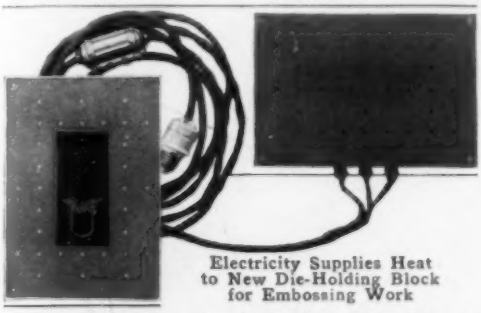
MONSTER BELT IS USED IN SUGAR REFINERY

A seven-ply rubber belt, 1,443 ft. long, a yard wide, and weighing nearly six tons, was recently manufactured for a sugar refinery. It will be used as a conveyor of bagged sugar through the factory, carrying an immense load each day. The bags weigh 125 lb. each and fall on the belt from a height of 4 ft. Though rather rough treatment, the belt stands up well in this service. When new and freshly coiled up in the factory, the belt made a huge roll nearly eight feet in diameter.

Huge Rubber Conveyor Belt is Built for Hard Service in Sugar Refinery

ELECTRICITY SUPPLIES HEAT FOR EMBOSSING

Embossing processes work much better when the dies are kept continuously hot. But it is often difficult to get the heat just at the point desired, and the steam or gas arrangements heretofore used have been cumbersome and hard to manipulate. A new electric embossing block is designed to make the work simpler. It consists of a die-holding plate back of which are three heating units controlled by a switch on the supply cord. This plate may be locked in the forms of any job press, and with its aid regular embossing work turned out. Most any form of die may be firmly held to its surface by means of screws through the many

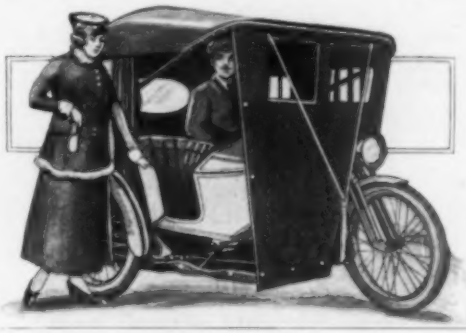


Electricity Supplies Heat to New Die-Holding Block for Embossing Work

holes, and thus the heat from the block is transferred directly to the die at the point where most needed. Attaching dies to the block by means of screws prevents the slipping which sometimes troubles other methods. Current consumption of the heating units is not excessive.

MOTORCYCLE AND SIDECAR FITTED FOR WINTER

To completely inclose a motorcycle and its sidecar, giving thorough protection from rain and cold winds, a top has been devised which makes such a conveyance really practical for winter use. The whole contrivance is shielded, since an apron extends beneath the machine and prevents air currents sweeping in from below. The heat given off by the motor is sufficient to keep the interior quite comfortable even when the mercury is down. In the front curtain, which is provided with a liberal amount of window space,

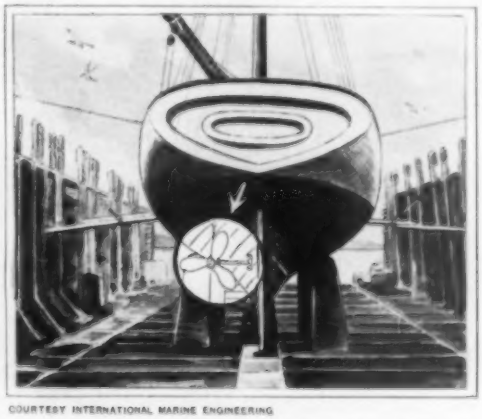


The Top and Side Curtains Provide Ample Protection during Severely Cold Weather

as are also the side and back drops, there is a small opening which allows the entrance of enough air to keep the engine cylinders from overheating. When thus equipped, only the wheels of a machine are exposed. The top is not unsightly, is built on a substantial frame, and does not interfere with safe driving.

SCHOONER HAS PROPELLER MOUNTED OFF CENTER

An unusual engine installation was lately made in a pilot schooner working out of an American harbor. It was desired to propel the boat by means of an oil engine, but this involved putting in a propeller and shaft. Not wishing



COURTESY INTERNATIONAL MARINE ENGINEERING

Propeller Shaft Carried Out of Port Side of Vessel Instead of through Sternpost

to disturb the rudderpost or other parts of the extreme stern in order to get the propeller on a center line of the vessel, it was decided to thrust the shaft through the side of the ship and let the propeller operate beside the sternpost instead of through it. In order that the propeller so mounted might not interfere with the steering qualities of the ship, the center of the engine shaft was kept practically at the center of lateral resistance. By so doing the propeller's effect on steering would be nearly neutral with the vessel going straight ahead.

BICYCLE ATTACHMENT MAY CARRY RIDER OR LUGGAGE

An attachment of simple and apparently strong construction has lately been devised for use on bicycles. To

Attachment above Rear Wheel of Bicycle Either may Support an Extra Rider or Carry Luggage

the seat post of a bicycle a steel rod is clamped, which is supported by two ribbed braces reaching up from the rear hub. On the steel rod so attached a second saddle may be clamped, converting the wheel into a tandem bicycle. Or, if desired, two wire baskets may be hung on the rod, one on either side, thus providing a strong and roomy luggage carrier, which is said to be capable of supporting a weight of 400 lb. When the attachment is being used to carry an extra rider, adjustable L-shaped steps are provided which may be hung on the ribbed braces as a foot support for the passenger.

TUNNEL 11,088 FEET LONG FOR JAPANESE TRAMWAY

As a part of an electric railway line built to connect Osaka, one of the chief commercial cities of Japan, with Nara, about 19 miles distant, there has been constructed a tunnel which penetrates the Ikomayama Mountains; in cross-sectional area it is said to be the largest tunnel in Japan. Its length, 11,088 ft., is said to be exceeded by only one other Japanese tunnel, namely, the Sasago tunnel, which is 15,279 ft. long, but will only accommodate a single railroad track. The more recent Ikoma tunnel, as it is called, is double-tracked. It required two years and eight months to complete the undertaking. The tunnel's location was accurately established by two independent triangulations; for the alinement a transit with a 15-in. telescope was employed. This was placed on a wooden tower on the highest point of the mountain. Because the wind swayed the tower slightly, it was necessary to make the observations on a very calm day. Excavations were begun at both ends simultaneously. The final error in alinement was only 1.3 in. in two miles. In making the excavations enormous rock pressure was encountered where water was in the fissures. On one occasion this caused a mass of rock to fall at a point 2,800 ft. from the eastern entrance, killing 19 men and imprisoning 147 others, who were rescued 49 hours later in a very exhausted condition.

¶The bullets in a new shrapnel shell are welded to a wire, which, when the shell explodes, is thrown forward with a rapid whirling motion. The shell is apparently intended for breaking down wire entanglements.

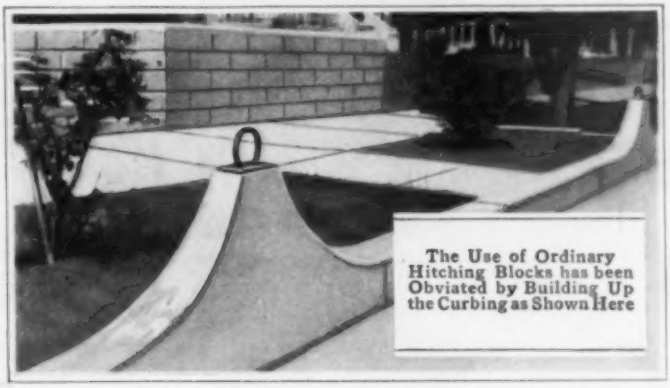
ODD SEMIPRECIOUS STONE IS ASTERIATED QUARTZ

When exposed to the direct rays of the sun, or some other bright light, a new semiprecious stone which is being mounted in rings and la vallières exhibits in its depths a figure similar to a six-pointed star. It is recognized as an asteriated quartz, and because of its peculiarity, has been given the name of "starolite." The optical phenomenon is accounted for by the presence within the stone of numerous tiny air spaces that reflect the light in a star shape when the gem is cut in a convex form and not faceted. It is found in this country and is described as resembling a moonstone in coloring.

¶While the United States government was transferring a new 16-in. gun through the Hoosac tunnel on its way to the Sandy Hook proving ground recently, all lights in the tunnel were turned out to prevent the possibility of a short circuit caused by the presence of so large an amount of steel.

CONCRETE HITCHING POSTS PART OF STREET CURBING

Concrete hitching posts of a novel character are used in front of the Santa Aña residence of a Californian.



The Use of Ordinary Hitching Blocks has been Obviated by Building Up the Curbing as Shown Here

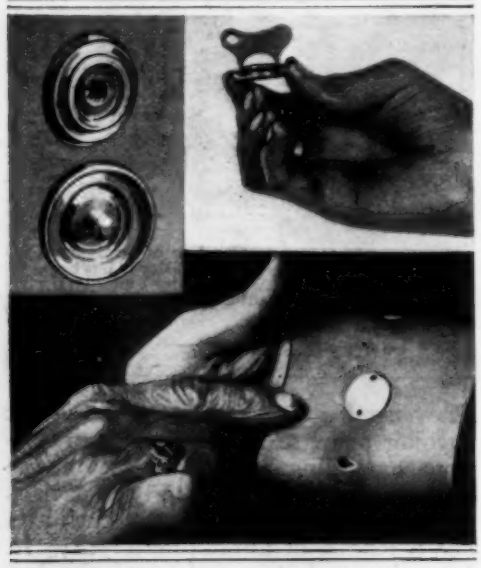
They are built as a part of the street curbing and are merely heavy projections extending about two feet above the parking level. At the base each is of the same thickness as the curb and has a length of approximately 3½ ft. Likewise each tapers toward the top where a curved rod is firmly anchored and a heavy iron plate used as a covering for the concrete. They are separated by a cement walk which extends to the steps in front of the house. The general effect is both odd and attractive.

CYPRESS SHINGLES RESIST STORM BETTER THAN SLATE

AN UNUSUAL result of the storm which recently wrought havoc in New Orleans was the shattering of a slate roof on a house which was badly wrenched also. A few feet away stood a barn with a cypress shingle roof that was scarcely damaged.

TIRE-REPAIR WASHERS GRIP RUBBER LIKE VISE

For quick repairs to small holes in rubber tires a northern automobilist has brought out a clamplike contriv-



One-Half of This Clamp is Placed inside the Tire, and the Other Half Screwed onto It from Without

ance which, even though an emergency device, he claims has given satisfactory service over a 2,000-mile run. The invention consists merely of two simple washers, one rather cone-shaped and the other correspondingly concave, a suitable bolt connecting the two. In use, one of the washers is placed inside the tire and the other screwed onto it from without by means of a detachable key. As a result the rubber tissue is firmly held between the two halves of the clamp, entirely preventing, it is claimed, the escape of air from the hole.

"LIVE" RESTAURANT RAIL CAUSES DEATH

A restaurant helper in Wales recently lost his life because of an electrical connection which had been made between a brass rail in front of the restaurant counter and a supply main. The restaurant proprietor, an Italian, who had caused this connection to be made, also placed in the floor in front of the counter a metal plate. While standing on the latter the helper accidentally touched the brass rail, with fatal results. This device, which the coroner afterward characterized as "stupid," was installed, the restaurant owner testified, to prevent small boys from stealing food from the counter. While the supply pressure was 220 volts, tests after the accident showed that 30 volts was the maximum that could be obtained from the rail. The facts that the helper was in poor health and had a weak heart apparently were causes contributing to his death.

SOLDIERS SCALE SEA WALL IN IMPROMPTU FASHION

The happy-go-lucky expedients to which American soldiers in the field resort in order to gain a desired end, and at the same time save themselves excessive labor, is interestingly demonstrated in an odd ladder recently devised to scale a sea wall on the Texas coast. Two old posts and scattered bits of driftwood were all the material available for its construction. The posts were laid side by side against the wall as the supporting beams, while stability to the steps laid thereon was secured by bracing one foot rest

Soldiers on Texas Gulf Coast Use Impromptu Means for Scaling Sea Wall: Ladder is Made of Driftwood

against the next. Two old ropes provided the balustrade. This ladder saved the builders much exertion each day in scaling the wall by sheer force of arm and leg, as well as in footing it by roundabout paths to ascend the barrier at easier points.

INDIAN MUSIC RECORDED BY PHONOGRAPH

The preservation for posterity of about a thousand ancient Indian songs, such as once were sung all over this continent, has been accomplished by means of the phonograph, as a part of years of research conducted by the Bureau of American Ethnology under the Smithsonian Institution. Many of these musical efforts are quaint and very beautiful. In addition to recording them phonographically elaborate notations have been made regarding the singers and the history and religious meaning of the compositions. An especially constructed recording horn and recorder were part of the equipment used. Great care was exercised to secure native singers with good voices.

LOUIS XVI DESK COSTS FOUR YEARS' LABOR

A desk, which took four years to construct, and is now valued at $5,000, was recently completed by two artists in wood. It is an exact copy of one by David Rontgen, a famous wood carver of the 18th century, whose works in figural inlay are considered unsurpassed. A famous Louis XVI desk by him is now in the Austrian National Museum of Arts in Vienna, and this was studied by the two artists during six years. The only difference between the original desk and its copy is that the older one was made of Italian walnut with bronze decorations, while the replica is entirely of mahogany, excepting only the bits of inlaid wood.

The desk rises in four tiers, the lower three of which are paneled with inlay work. The top tier serves as a mounting for a clock. The whole affair stands a fraction over 9 ft. high and is 4½ ft. wide. Painting, architecture, sculpture, and music are represented pictorially in the inlay work, an accomplishment requiring a great deal of labor and artistic sense. Over 40 different kinds of woods, which the wood carvers themselves collected during several years, are used to give the many colors. A few of these varieties are: three kinds of rosewood for the red shades; ebony for the black; primavera, bird's-eye maple, and white maple for the yellows and greens; white oak and holly for the light whites; and Italian and black walnut for the browns.

Copy of Famous Louis XVI Desk Which Took Four Years to Construct and is Decorated with Beautiful Inlaid Woods

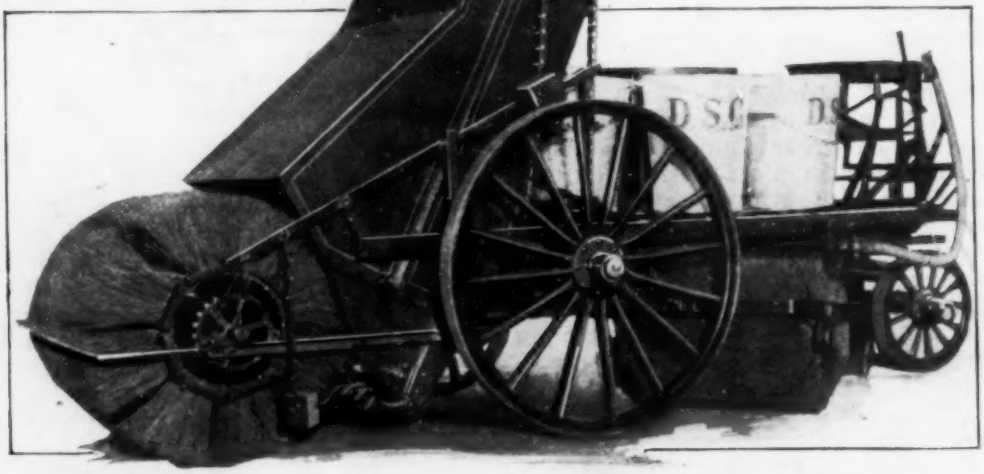
AUTO RACER IS GUIDED BY ARMLESS DRIVER

An unusual method of handling an automobile was lately devised for the benefit of an armless driver. In place of spokes in the steering wheel a number of small hoops were provided. In these the driver may insert the arm stumps, thus guiding the car. Gasoline and spark levers are located above the wheel, that they may readily be moved with the same shortened limbs. Changes of gear are effected with a foot pedal. With a racing car thus fitted up, the driver has been touring the country, taking part in such speed events as were encountered. Speeds up to 58 miles per hour have thus far been obtained with this odd method of control. The handicaps under which the driver labors make close attention necessary.

Armless Auto Driver Uses Stumps to Control Steering Wheel. Rings are Placed within the Wheel Especially for This Purpose

STREET CLEANER COLLECTS DIRT AS IT SWEEPS

Trials, which are said to have proved satisfactory, have recently been made in the East with a street-cleaning machine which sweeps and sprinkles a pavement in a single operation. Unlike many sweepers, this one picks up the dirt and deposits it in a series of trash receptacles, which are carried on a revolving rack back of the driver's seat, instead of merely sweeping it into the gutter from which it would have to be shoveled into wagons by "white wings." When the trash cans are filled with sweepings they may be removed and others put in their place, which makes it unnecessary for the sweeper to travel possibly several miles to a dump before unloading the refuse it has collected. This allows the machine to continue steadily throughout the day cleaning pavement. With a team of horses, one man, it is said, is able to sweep 62,000 sq. ft. in eight hours.



This Street-Cleaning and Sprinkling Machine Collects the Refuse Which It Sweeps from a Pavement

The Fine Residence of a Wealthy Guatemalan Sugar Raiser in Process of Construction. The Round Balls in Front of the House Are Heaps of Raw Brown Sugar Ready to be Carried on the Backs of Natives to a Refinery Perhaps a Hundred Miles or So Away

SUGAR KING'S PALACE HAS THATCHED ROOF

Little of the pomp and circumstance which surrounds American wealth troubles the richer landowners of the neighboring republic of Guatemala. The construction of a fine residence is a simple matter. One recently built by a wealthy sugar raiser is an interesting example. Constructed of the building materials always to be had for the taking in the rural districts, no great money outlay in its building was necessary. The walls are of adobe, obtained by the simple process of digging mud out of the ground. This material was formed into rough squares and baked simply by the heat of the sun. For the roof a heavy thatch of leaves from the cocoa palm was used. Native Indians do the work and are capable of turning out rather neatly built structures if given plenty of time. In the mountain districts some of the houses are round with conical roofs. The natives cap the tips on these cones with an inverted earthenware bowl to keep out the rain.

¶A contract for 5,000,000 yd. of heavy woolen cloth, enough to supply 1,250,000 overcoats, has been let to an American firm by the Russian government.

ELECTRIC CAPS FIRED WITH POCKET BLASTING MACHINE

One of the latest conveniences for use in coal mining, quarrying, and other work in which blasting is required, is a pocket machine capable of firing as many as five electrical caps simultaneously. Unlike the ordinary blasting machine, which is comparatively heavy and must be set up on level ground, this little machine weighs only 4½ lb. and is held in the hand when being used. In operating it, all that is necessary is to connect the wires leading to the charges, unscrew the cap attached to one end of the flexible handle, insert a key in the opening thus uncovered in the case, and give the key a quick, sharp twist. This generates the current that fires the caps. To guard against meddlers the blaster has only to keep the key in

his pocket, as the machine cannot be operated without the key. The machine is 4½ in. high, 3⅝ in. wide, and 2⅛ in. thick, and is rounded at the edges so that it slips readily into the coat pocket.

HISTORICAL MAP OF HARVARD YARD MADE IN CONCRETE

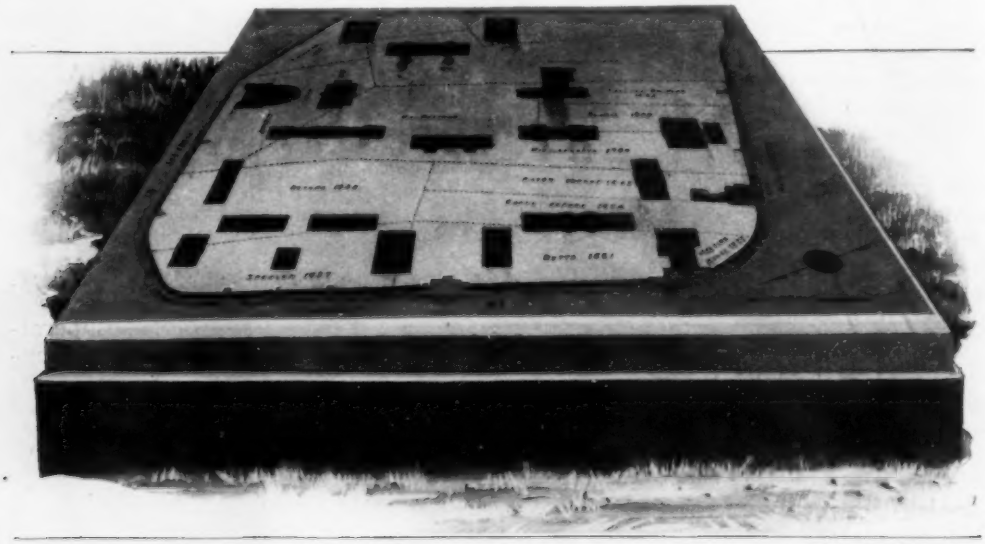
In front of University Hall at Cambridge there is a concrete slab on which a permanent map of Harvard Yard has been worked out in an interesting manner. It shows the plan of the grounds, the sites and outlines of its various buildings, and the relative locations of the individual pieces of property acquired at different periods. Each tablet representing a university structure bears the name of the building and the date of its erection. The diagrams of original properties are marked off with dotted lines and in most instances named and dated. One of these plots bears the inscription, "Before 1642," and others, "Eaton before 1642," "Fellows' Orchard 1642," "Foster Estate 1836," and so on. The streets surrounding the yard are indicated, as are the gates and fence. The slab is raised about two feet.

HUED ENAMELS FOR HEATING AND COOKING STOVES

Kitchen and heating stoves of various hues, in place of the deadly black, are a possible result of experiments now being undertaken by the United States Bureau of Standards to develop satisfactory colored enamels for cast iron. The present popular tendency to decorate coal stoves has proven a stimulus to this investigation. A good ground coat already has been developed, as well as a white cover coat for cast-iron stove parts. The white coat produced contains oxide of antimony in place of the more commonly used, but expensive, tin oxide.

NEW SYSTEM OF HIGH-SPEED METAL CUTTING

Cutter speeds and feeds from eight to ten times as high as those used in ordinary practice are made possible by a new system for cutting and milling metals that has recently been introduced. The essential feature of the system is the lubricant, which is supplied in about ten times the quantity heretofore used, so that the cutters work in a flowing stream of oil. For

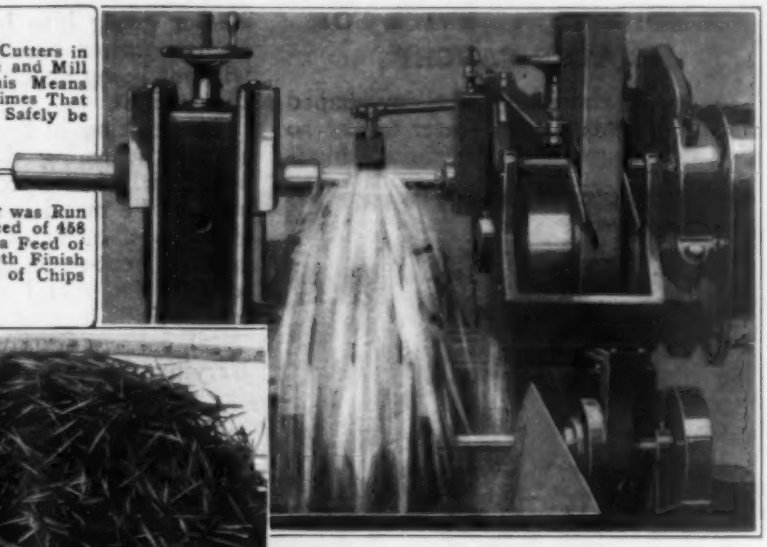


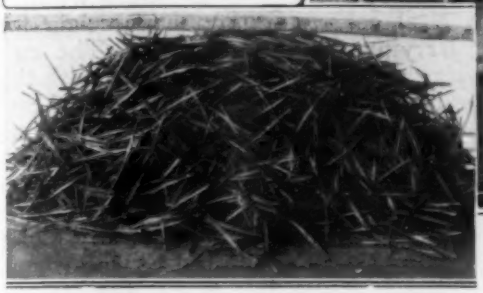
COPYRIGHT, BOSTON PHOTO NEWS CO.

Each Tablet Represents a Harvard Building and Shows Its Date of Erection

Stream of Oil Cools Cutters in New System of Lathe and Mill Manipulation. By This Means Cutter Speed Ten Times That Ordinarily Used may Safely be Employed

In One Test the Cutter was Run with a Peripheral Speed of 458 Feet per Minute and a Feed of 30½ Inches. A Smooth Finish and an Immense Pile of Chips Resulted

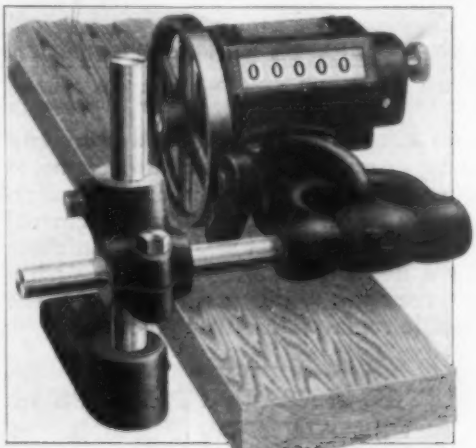




this reason the term "stream lubrication" has been applied to the system. The oil is supplied by a centrifugal pump which works in a reservoir located in the base of the machine, the oil being passed through a strainer as it leaves the cutter table and used repeatedly. To confine the oil directly to the work the table is covered with a hood. Provided the quantity is sufficient, almost any kind of lubricant can be used, the principal action of the oil being that of cooling. In one test with a spiral mill cutter, the cutter was run with a peripheral speed of 458 ft. per minute and with a feed of 30½ in. per minute, and the resulting finish was sufficiently good for surfaces that are to be bolted together.

LUMBER METER CHECKS WORK OF MACHINE

As an aid to determining the efficiency of woodworking machinery, a lumber meter has been invented. It consists of a barrellike mechanism much resembling the cyclometer on a bicycle, only larger. A wheel at one side of the case operates the registering machinery, the wheel being made to turn because of friction with passing lumber. The machine may be used on molders, matchers, flooring machines, self-feed ripsaws, and the like. On these it will record the number of linear feet passing through during a given period, enabling efficiency experts and



Machine Measures Passing Lumber, Enabling Efficiency of Machinery to be Determined

factory managements to decide whether the machine is giving its maximum usefulness or not.

¶The German auxiliary cruiser "Kronprinz Wilhelm" is to be refitted as a passenger liner, but will remain interned at Norfolk until the end of the war.

COMBINATION DEVICE FOR WATER FAUCET

A device consisting of a cup-shaped nozzle mounted on a water faucet so that it acts as a sanitary drinking fountain when turned upward and as an ordinary nozzle when turned downward is one of the latest conveniences in water-supply fixtures. The nozzle is carried on a tapering shaft and is held in place by a nut which is tightened to such a degree that, while easily movable, the nozzle remains in either position.

Tilting Cup Upward Makes Faucet Serve as Drinking Fountain in Addition to Ordinary Functions

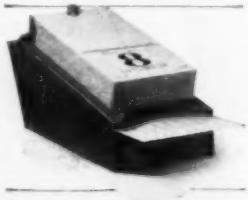
METAL-SPRAYING PROCESS IS USED IN NEW FIELDS

Manufacturing cartridge cases by the metal-spraying process is a feat lately accomplished in the munitions-making field. The cartridges are first shaped up out of pasteboard, and later covered over with metal by the sprayer. Ammunition so made is said to be equal to the ordinary kind having metal cases, and because of its greater lightness is much easier handled and transported by freight or vessel. Also, a soldier going into battle can load up with a larger supply of ammunition without being encumbered with excessive weight.

The making of heating elements for electric warming devices is another field in which the process is now being used. The metal is sprayed on porcelain tubes, or other suitable nonconducting, heat-resisting surfaces. After cooling, the metal shell is cut along certain lines, leaving in relief a wirelike spiral conductor on the porcelain for carrying heating currents. The cutting processes are carried out with the aid of electricity and a thin-edged carbon wheel. The wheel serves as one electrode of a low-voltage current and the metal coating as the other. A high current thereupon passed across the junction melts the metal neatly along whatever path followed by the wheel. Thus it is possible to cut the casings into other designs than spirals if desired.

SPACE FOR NOTATION SLIPS IN CALENDAR STAND

For the business man's desk a steel calendar stand is being made with a pocket in its base designed to accommodate 200 memorandum cards, 3 by 5 in. in size. In other respects the device is of the ordinary form and will receive a standard calendar pad such as is supplied by all stationers. It is finished in green enamel, has rounded corners, and is light in weight. By utilizing the space thus provided, it is unnecessary to add to the number of articles on a desk by using a special receiver for the notation slips.



¶The first ship to comply with the new Federal seaman's law was the "El Monte," which left Galveston not long ago with a crew that had qualified by examination for coastwise service.

TWO EMBLEMS OF LIBERTY ASSOCIATE AT EXPOSITION

The ancient Liberty Bell of Revolutionary War fame was on exhibition during the past summer at the Panama-Pacific Exposition. Near it hung another old emblem of liberty, a rug of much more ancient history, yet holding a position among its own people strangely like that of the Liberty Bell among Americans.

The rug belonged to the Persians and was loaned by their shah especially for the exposition. It has a history dating back some 400 years B. C. At that time, it seems, Persia had a ruler by the name of Hoo Shang, who upon one occasion turned loose some 500 prisoners that were shut up because of religious beliefs. Out of gratitude the prisoners set to work on a marvelous rug which they presented to their liberator upon completion. Since then the rug has been handed down through the centuries, early acquiring a romantic significance among the Persians because of the story of its weaving.

HARD ROADS MADE FROM HOT ASPHALT AND PEA STONE

Heavy asphaltic material applied hot under pressure, over which was spread a very liberal coating of pea stone, has proven a substantial and lasting composition for roads in a Canadian park. The surface of these thoroughfares has worn well and has been impervious to water. The repairing has been done while the depressions were still small, instead of allowing the roads gradually to deteriorate until extensive resurfacing was necessary. This method of maintenance was found to be comparatively inexpensive.

BEANS IN LARGE QUANTITIES SORTED BY MACHINERY

For sorting large quantities of beans and removing those which are shriveled, a Minnesota inventor has constructed an apparatus which works quite efficiently.

With a Half Dozen Machines a Car of Beans can be Sorted in Ten Days

Beneath, and extending in an inclined position from, one side of a hopper is a series of cylinders geared in pairs so that they revolve together like the rollers of a clothes wringer. The beans are guided through chutes to the upper ends of the rotating cylinders. Those with rough surfaces are caught between these members and eliminated. Smooth-surfaced beans, however, are allowed to slide down between the rollers onto a belt conveyor. The operator of the machine, who is seated at one end of this traveling apron, picks out by hand all of the black beans that may appear. A battery of six such apparatuses have sorted a car load of beans in 10 days.

LAMP FOR EYE, EAR, AND NOSE OPERATIONS

When an operation on the eye, ear, or nose is to be performed in the home, or under other conditions where the usual lighting facilities provided in hospitals are not available, the greatest difficulty is often that of directing

a ray of light to the part to be operated on. To overcome this difficulty there has been devised a special electric lamp

Adjustable Electric Lamp for Eye, Ear, and Nose Operations: With the Fiber Mouthpiece Held between the Surgeon's Teeth the Light can be Directed to Any Desired Point

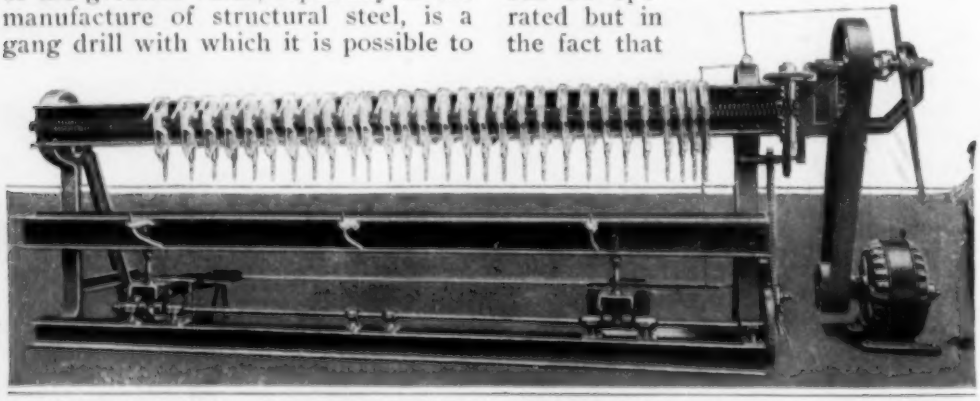
mounted on a fiber mouthpiece which is held between the surgeon's teeth. The lamp is connected to the mouthpiece by a series of links and universal joints so that it is easily raised or lowered, or turned in any direction with reference to the mouthpiece, an arrangement that makes it possible to direct the light to any desired point. Current for the lamp is supplied by a dry-cell battery which is inclosed in a case that can be carried in the pocket of the coat or vest. This battery is capable of supplying light for a period of about four hours.

BAROMETER IS ILLUMINATED BY GROOVE IN MOUNTING

As usually placed, a barometer is rather difficult to read, due to the black background commonly present. An English scientist has worked out a more satisfactory scheme. A board about six inches wide and somewhat longer than the barometer tube is hung in a window. Down the middle of the board a long narrow groove allows a restricted amount of light to pass through. Covering this slit with paper or ground glass reduces the light to a soft glow. Upon mounting the barometer tube in front of the groove a sheet of light illuminates its whole length, making reading an easy matter, with less eyestrain.

GANG DRILL FOR WORKING STRUCTURAL STEEL

A new machine that is likely to prove of the greatest value, especially in the manufacture of structural steel, is a gang drill with which it is possible to drill accurately as many as 50 holes at one operation. The value of the machine in this kind of manufacture lies not only in the economy with which it can be operated but in the fact that



With This Gang Drill as Many as 50 Rivet Holes may be Drilled in a Steel Beam at One Operation

it presents a practical means for substituting drilling for punching in the making of rivet holes, a thing that has long been recognized as desirable among makers of structural steel. The essential feature of the machine is a set of movable drill heads mounted on a horizontal beam with the drill bits projecting downward. These bits are equipped with sprockets through which they are driven by an endless chain that runs lengthwise of the beam and is operated by a driving mechanism at one end. The beam and drills do not move vertically, the material being fed up against the drill bits. For this purpose a table that moves in vertical guides is provided on which the material to be drilled is placed and clamped. The machine drills holes up to 1 in. in diameter through metal as much as 4 in. in thickness, and the drill heads can be set for any pitch with a minimum of 2¾ in. The machine is capable of handling a beam 24 ft. long, 20 in. wide, and 24 in. deep. It is easily possible to handle beams longer than 24 ft. if the work is shifted.

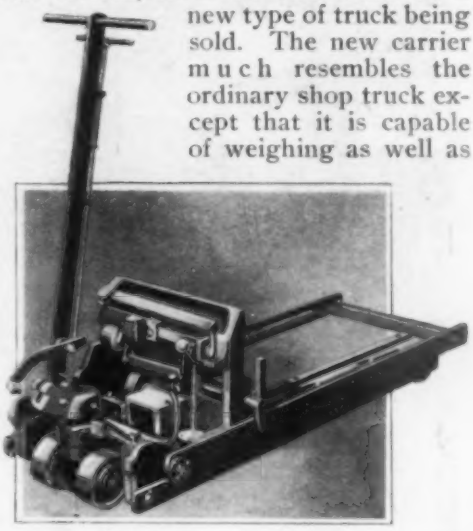
MORE GIFTS OF TELESCOPES ASKED BY BRITISH

The British government has recently repeated its former request for the gift or loan of telescopes that can be used with the batteries at the front. The appeal to the public says that telescopes on stands, deer-stalking telescopes, good pocket telescopes—in short anything that is not a toy—will be acceptable. Astronomical eyepieces not wanted for service will be removed and carefully numbered to correspond to the instruments from which they are taken, so that eventually the instruments may be returned to their owners intact.

¶Detectives of an eastern railroad are constantly on the lookout to take photographs of any employe seen taking a drink of alcoholic liquor. On the same road the use of whisky as first aid to the injured has been prohibited.

SCALE TRUCK WEIGHS GOODS WITHOUT UNLOADING

Loading and unloading small trucks for the purpose of weighing the material carried, is to be eliminated in a new type of truck being sold. The new carrier much resembles the ordinary shop truck except that it is capable of weighing as well as transporting its load. The top of the machine serves as the load holder for a platform scale, the weighing being done in the usual manner by sliding a weight along a beam. After weighing, the load may be lifted by moving a lever. The weight then rests on the side rods, relieving the scale mechanism of strain during transportation operations.

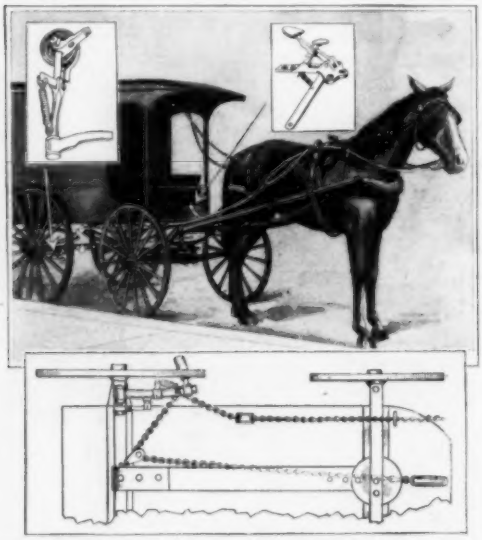


A Platform Scale is Made an Integral Part of This Shop Truck, and Unloading Heavy Weights for Weighing Purposes Is Unnecessary

AUTOMATIC ANCHOR FOR STANDING HORSES

According to members of the profession, one drawback to the driving of a laundry or other delivery wagon is that a heavy weight with a hitch strap tied to it has to be dropped out at every residence to keep the horse from running away. When such a weight has to be lifted in and out of the wagon a hundred or more times per day, it means considerable work. A Minneapolis manufacturer would prevent all this with an automatic device. When

the driver leaves his seat he disengages a lever with his foot, which permits a contrivance located on the hind axle to swing out and catch between the spokes of a rear wheel. Attached to



Horse is Prevented from Running Away by Lever Which Driver Locks into Hind Wheel with Foot Pedal upon Leaving. Rotation of Wheel Pulls on Lines, Stopping Horse

this apparatus is a pair of lines running to the horse's bit. Should the animal start to run away, the hind wheels, of course, revolve, causing a pull on these lines and theoretically bringing the horse to his haunches.

SCARCITY OF COLORED INK EMBARRASSES PUBLISHERS

Scarcity of dye materials for printing inks, due to the war, has caused one technical magazine, which for years has used a distinctive red cover, to resort to American substitutes. These have been so far from satisfactory that editorial explanation of the altered color of the magazine's cover has been made in its columns. Many other magazines have experienced similar embarrassment. Fortunately, Popular Mechanics Magazine, which likewise has been dependent on European markets for dyes in its cover inks, has on hand a supply sufficient to last for several years.

ECONOMIC FORCES MAY JOIN AGAINST FUTURE WARS

Of the many current proposals to lessen the probability of war in the future, one put forth as a referendum to the members of the Chamber of Commerce of the United States possesses certain features which raise the interesting question as to whether business men and commercial interests generally can establish international rules which will constitute a serious check on would-be belligerent nations.

When the present gigantic strife is over, asserts the referendum, to enormous indemnities will be added a greater charge due to rival armaments; disastrous tariff walls are predicted as another result. Whether or not this reasoning is sound, it seems certain that Europe's purchasing power will be greatly decreased after the war, and indirectly neutral countries dependent on Europe for trade will be similarly affected. Shortage of capital and a possible decline in European standards of living are foreseen. All this makes the prevention of war, even though confined to other countries, one in which America is economically interested.

Among the proposals embodied in the referendum now being considered by chambers of commerce in every state and the American chambers of commerce in Berlin, Paris, Milan, and Constantinople, is one to the effect that this country lead in establishing an international court which will be governed by certain established rules. Supplementing this, is suggested a council of conciliation, to deal with differences to which existing rules do not apply.

Such nations as do not submit their differences to these agencies are to be subjected to concerted economic pressure—"commercial ostracism." This failing, military force will be resorted to. The referendum has already enlisted the support of many who believe that it furnishes a practical means of displacing war with law.

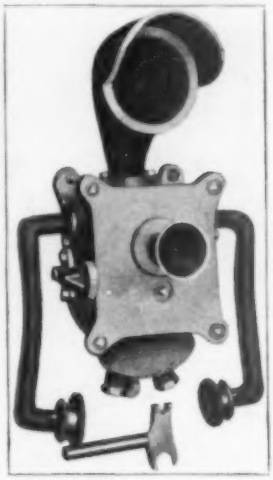
STEREOSCOPIC SUBSTITUTE FOR BULKY SAMPLES

As a substitute for bulky samples which often require many salesman's trunks, there has recently been brought out a binocular device which employs the principle of the old-fashioned stereoscope, but is more compact. The two-fold stereoscopic views used with this instrument are said to be much more effective than ordinary photographs in presenting vividly the merits of articles, particularly goods which cannot be well described, such as machinery. When in use, the instrument looks much like the familiar stereoscope, but by means of hinged joints it can be folded into small space. The specially mounted stereoscopic photographs also occupy small space, so that the instrument and 75 photographs can be inclosed in the case provided, which is no larger than a bill book.

¶Just as a jungle scene for the movies was completed the lion that played the leading part jumped for the camera and demolished it. Following this he walked calmly to the door of his cage and waited for the trainer to open it.

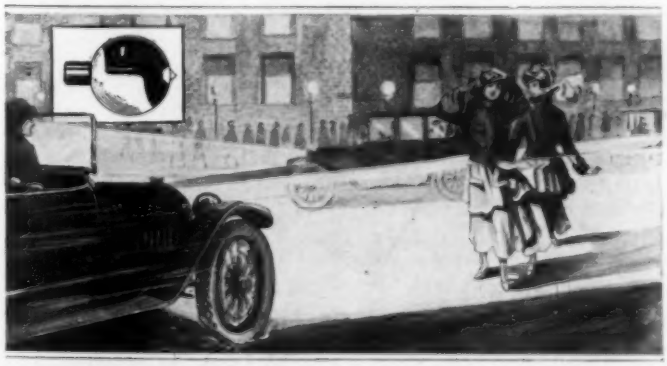
LOUD-SPEAKING TELEPHONE FOR USE IN MINE

Both for safety purposes and convenience, a loud-speaking telephone has been designed for underground mines. It is of heavy construction and capable of withstanding the effects of excessive moisture. The receivers are carried at the ends of two pivoted arms, while the megaphone extends like a funnel above the transmitter. An ordinary telephone conversation may be carried on with the instrument, or the loud-speaking part used for conveying instructions to different parts of a mine, or sounding a general alarm in case of an emergency.



FROSTED BULB ELIMINATES HEADLIGHT GLARE

There are many contrivances on the market at present for the elimination of automobile headlight glare, but one just put out by an eastern manufacturer seems to have elements of simplicity. His idea embodies the use of an electric-light bulb frosted on one side. This light is placed in the lamp with the frosted side down. By the action of the reflector light through the frosted side is thrown upward, and through the clear part downward. The claim is made that an observer coming from the opposite direction sees only the pleasant glow from the frosted side as a result, while the bright portion illuminates the road in the usual manner, its brilliancy undiminished.



The Light through the Frosted Half of the Lamp in This Headlight is Projected to the Eyes of the Observer, Limiting the Glare

CONCRETE PILE DRIVEN LIKE WOODEN ONE

One of the latest inventions in the way of concrete construction is a reinforced-concrete pile that can be driven

This Reinforced-Concrete Pile is Provided with a Core, Driving Head, and Driving Shoe, All of Steel, and can be Driven Like a Wooden Pile

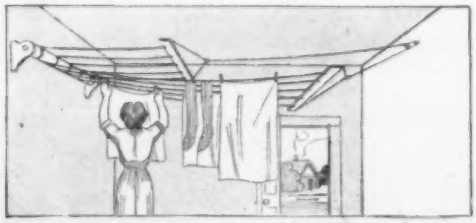
in the same manner as a wooden pile with practically no danger of injury in the process. Running through the center of the pile from top to bottom is a conical tube which tapers toward the bottom and forms a steel core for the pile. To the top of this core a steel driving head is riveted, while a pointed steel driving shoe, having a threaded recess, is screwed to a threaded shank at the bottom. The concrete, which may be reinforced with steel mesh, is molded around this core so that the surface comes flush with the driving shoe and just fills an annular recess in the driving head. Two eyebolts screwed into the core and projecting beyond the concrete surface are used for handling the pile.

FLEXIBLE COATING IS NEW INSULATOR FOR ALUMINUM

Because aluminum is a poorer conductor of electricity than copper, a wire of the former material must be made with a much larger cross section than the latter in order to have the same current-carrying capacity. This has made it difficult for aluminum to compete with copper, particularly among the insulated wires where the larger cross section requires so much larger covering. A new insulating skin for aluminum has lately been devised, however, which promises to extend the field open to this metal. The new covering is made by passing the wire through electrolytic baths in which borax, aluminum borate, or sodium silicate are dissolved. In this process the wire serves as the anode. It emerges from one kind of a solution with a smooth, iridescent covering, or with a hard abrasive coat when another is used. The latter insulator will stand from 200 to 500 volts, and is only .0001 to .0004 in. thick. Wire coated in either way will stand bending but not rubbing, due to the fact that the coating is flexible but not free from abrasive elements.

A MULTIPLE-LINE CLOTHES DRIER

One of the latest conveniences for the housewife is a clothes drier consisting of five lines spaced apart by wooden end pieces and arranged to work on the principle of an endless chain. The five lines work on spaced pulleys supported on a wall or window ledge, while the single line that connects the end pieces works on a pulley that is supported either by a wall or a post. With this arrangement the lines can be filled from one point and drawn back and forth as required. The capacity of this system is five times that of a single line extending between the



This Clothes Drier Consists of Five Lines That are Spaced Apart by Wooden End Pieces

same supports, so that in a room 14 ft. wide, there is 70 ft. of line available. The five lines occupy a space 18 in. wide.

¶A uniform system of type for the blind is now being introduced. Heretofore there have been five systems in use.

Collapsible Canvas Hood is Arranged to Cover a Vehicle in Time of Storm or Hot Weather

COLLAPSIBLE HOOD COVERS OMNIBUS TOP

An English invention lately marketed provides omnibus passengers with protection in time of rain or hot sun, and at other periods gives them all the conveniences of an open-air vehicle. A canvas hood, mounted on several U-shaped stays, is so arranged that by turning a small crank at the front end of the vehicle it may be raised and slid back along a track until it covers the whole top. When not in use, it folds compactly in a space above the driver's seat, leaving the top of the bus in open air and the passengers with an unobstructed view.

EFFICIENCY THERMOMETERS EMPLOYED IN OFFICE

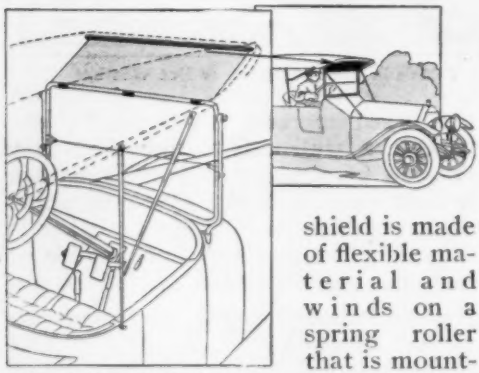
As a means of stimulating activity and increasing the efficiency of his office force, the manager of a Michigan business concern has inaugurated an interesting grading system. Printed cards bearing the general outline of a graduated mercury thermometer are kept in a wall case where they may be read by the employes. Each card bears a date line and a space on which the number of an individual worker is written. The quantity and quality of each employe's work is graded once a

The Cards Indicate the Efficiency of Each Employe in the Office of a Michigan Concern

week on a percentage basis. The cards are marked by filling in the "tube" spaces with red ink. When the column extends to the 85° point, for instance, it indicates that that was the efficiency reached during a certain week by the employe whose number the card bears. Although savoring of the time-clock system, the method is said to have proved beneficial, as it has tended to create friendly rivalry and encourage better work.

SHIELD STOPS DRAFT UNDER AUTOMOBILE TOP

A new attachment for automobiles is a shield that prevents the wind from streaming in between the glass windshield and the automobile top. This



This Flexible Shield Prevents the Wind from Streaming In between the Glass Windshield and the Automobile Top

shield is made of flexible material and winds on a spring roller that is mounted at the front of the automobile top and works after the fashion of a window-curtain roller. It is held to the top of the windshield by spring clips and winds up out of the way when these clips are released.

MAKING WARSHIPS INVISIBLE TO HOSTILE FLEETS

Once more the Navy Department is directing attention to the problem of devising some method of painting our war vessels so as to render them practically invisible to an enemy. Considerable thought has been given to this in the past, but so far as is evident, without especial success. At the present, however, experiments are being conducted with a flotilla of destroyers on the coast of New England.

Although at first thought, the matter seems rather fantastic to the lay mind, it is nevertheless a subject of serious import. Already worth-while results have been attained by the British and Italians. The splotchwork painting of the fighters operating at the Dardanelles has been described previously. An Italian destroyer has also been painted with a false "bone in its teeth," which is intended to deceive the enemy's gunners by making them misjudge the speed of the vessel when firing.

Several years ago apparently remarkable results were accomplished by a New York artist. Although his plan seemed to be of value to the naval authorities, consideration of it was ultimately dropped because of the secrecy imposed. The principle of the scheme, to quote one authority, was "that a light on a surface oblique to the direction of the rays of light is less intense than on a surface perpendicular to the rays." The same tint or color of paint should not be used on a perpendicular surface, it has been reasoned, as is used on the oblique, if the desired effect is to be attained. The coloring of any surface, according to this, would depend upon the angle presented to the rays of light. The lighter colors would be used on shadowed surfaces, while the darker tints would be employed on normally lighted planes. The purpose of this is to make an object merge with its background. The difficulty encountered in accomplishing this obviously is that a ship is a moving body.

In order to demonstrate his scheme the eastern artist was allowed to work on the models of three ships. Two of these were painted in the usual manner, one being finished in white and the other in slate. The third was treated in accordance with the secret method. When the work was done, a number of officers were admitted to a well-lighted room in which the models were placed. The white and slate-colored ones were

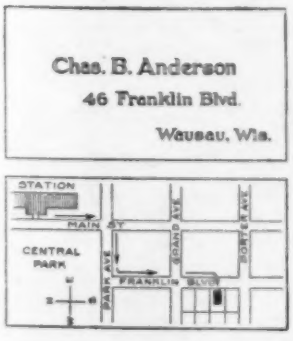
in full view. The third, however, was not in evidence. It was only by shifting their positions and looking from specific angles that the "invisible" boat could be discerned at all.

DIGGING TRENCHES IS TO SUPPLANT "BAG RUSH"

The old "bag rush" at Tufts College in Massachusetts is to be abolished as a method of settling class differences in favor of a new sport somewhat warlike in nature. The rival classes separate into two groups and endeavor to intrench themselves as for a battle in the quickest possible time. After the expiration of a certain period, the side having nearest completed the task is adjudged the winner. Another contest of value in war training consists in carrying sand bags. Each side endeavors to get the most bags removed from a common pile to their own intrenchments. Such exercise is thought to give valuable training as well as serving as a substantial outlet for youthful spirits.

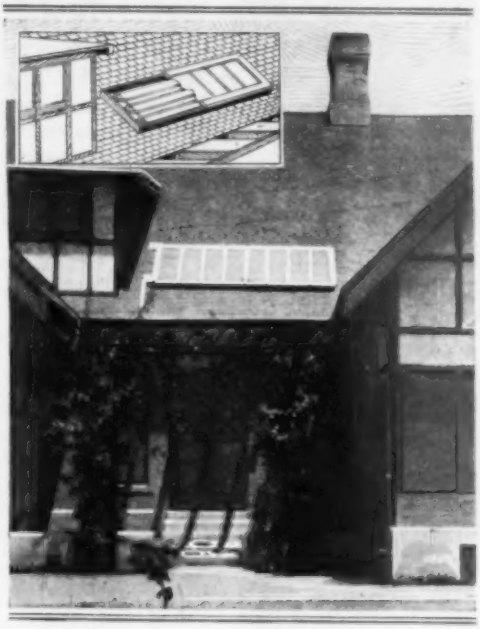
VISITING CARD WITH MAP ON ITS REVERSE SIDE

In order to show the location of a residence in relation to subway and elevated stations, or other transportation lines, some persons, both in this country and abroad, are coming to use visiting cards which carry small street maps on their reverse sides. The purpose is to furnish one unfamiliar with the neighborhood a diagram which may be of assistance when wishing to find the address.



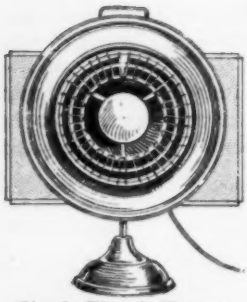
WARM WATER IS SUPPLIED BY NOVEL HEATER

Solar water heaters of simple, serviceable construction are coming to be used quite extensively in certain sections of the Southwest, where the sun shines the majority of the time and the days are warm almost the year around. One of these apparatus, designed for a residence, consists partly of a flat coil fixed in a shallow, rectangular box covered with glass. The exterior of the pipes and the inside of the housing are painted black so as to retain as much heat as possible. The device is mounted on the roof, usually on the south side of a house where it will get the benefit of the sun for the greatest number of hours. In the peak of the roof, or sometimes hidden in a false chimney, is a tank which is connected with both the coil and a supply pipe. The appliance furnishes warm water for household purposes without cost other than the initial expense of installation. It may be arranged so as not to detract from the appearance of a house.



As the Water is Heated It Circulates to the Top of the Tank, an Equal Volume of Cold Water being Returned to the Coil through a Supply Pipe

NOVEL AND PRACTICAL THINGS FOR THE HOME

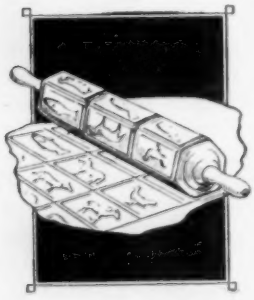


Simple Electric Heater for Small Rooms

SMALL rooms can be kept warm during damp, chilly weather by the use of a light, portable electric heater which operates at a cost of about seven cents an hour. In the middle of a reflector, and surrounded by the coils, is a frosted globe that gives off a pleasing glow. The device is 18 in. high and may be attached to any lighting socket by means of a flexible cord which is supplied with it. During very cold weather it serves nicely as an auxiliary, or emergency, radiator.

Basket Holds Clothes While in Boiler

One of the convenient devices lately introduced to lighten laundry work is a wire basket which fits inside of a boiler and holds the clothes while they are being sterilized. It is suspended on hooks which grip the edges of the container, holding it far enough from the bottom to permit free circulation of the water. When it is time to remove the linen, the basket is lifted out by means of two handles. This eliminates the need of using a clothes stick.

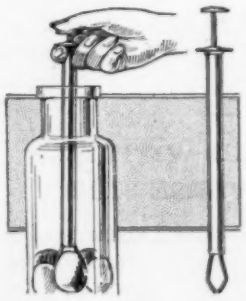


Cookie Roller Stamps Figures in Dough

Cookies and small cakes with various designs in relief may be made easily with the assistance of a six-sided roller which has a series of three dies on each of its surfaces. Eighteen cakes, each slightly less than 2 in. square, are stamped by revolving the device once.

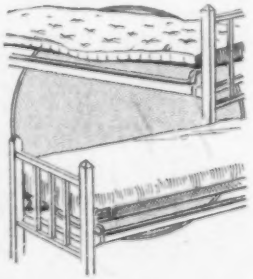
Convenient Kitchen Heater with Gas Kindler

To be set at either side of a gas range, a small kitchen stove is being constructed which uses wood, coal, or rubbish as fuel. It is fitted with a gas kindling attachment that enables coal to be ignited in a few minutes without the use of wood. It occupies a floor space 14 in. by 26 in. in size.



Attractive Tongs for Removing Olives from Bottle

For removing olives from deep bottles, long, slender silver-plated tongs are available which are both attractive in appearance and serviceable. They are provided with prongs which may be opened by pressing the thumb against a plunger at one end of the instrument. They are equally convenient when one wishes to remove a cork from the inside of a bottle.

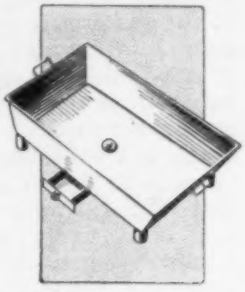


Side Guards Prevent Mattress from Spreading

Bed springs of a new type are being introduced which are designed to prevent the spreading and shifting of

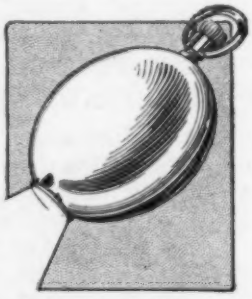
a mattress. They are provided with strong guards on each side which back up the mattress and hold it firmly in position. The side members are of link construction and held at each end by heavy coil springs.

Several good features are to be found in a rectangular dish pan especially designed to be used in a kitchen sink. It is supported on rubber-protected feet so that the waste pipe is not stopped when it is employed, nor the porcelain scratched. A removable, perforated drawer is fitted to the under side at the front. This serves as a grease trap and prevents the sink from becoming clogged.

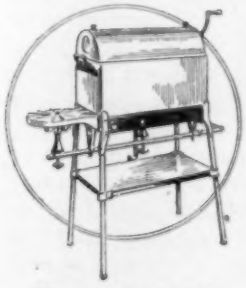


Dish Pan of Convenient Form for Kitchen Sink

Pocket flash lights are being made in numerous forms, but as novel as any is one fitted in a case similar to that of a watch. The lamp is sunk in the lower edge of the case, within which a compact battery is held. The device is intended to be carried in the vest pocket at the anchor end of a watch chain. Although it is an oddity, it is also serviceable for the person who objects to the weight of larger lamps.



Pocket Flash Light Made in Form of Watch



Compact Household Laundry Machine

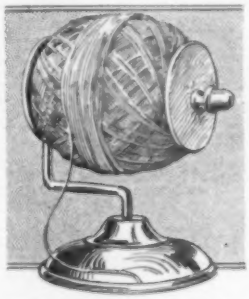
For domestic use a compact, gas-burning laundry apparatus has been invented which combines the properties of a washing machine, boiler, and stove. In principle it is somewhat similar to commercial washers and thoroughly cleans and sterilizes clothes in hot steam and boiling water in about 10 minutes. It is operated by turning a crank slowly.

Dish Rinser Fits over Hot-Water Faucet

Quite a convenient kitchen accessory is represented in a dish rinser designed to fit over a hot-water faucet. It is so constructed that by sliding a small lever to one side a spray is produced. By placing the dishes in a pan beneath this, they are thoroughly rinsed in a moment's time.

Drying Form for Children's Garments

To prevent the shrinkage of infants' garments after they have been washed, an adjustable form has been invented which keeps different pieces of apparel in the proper shape while they are drying. It is made of hard wood and folds into a small space when not in use. As a child grows, the form may be expanded to receive larger garments.

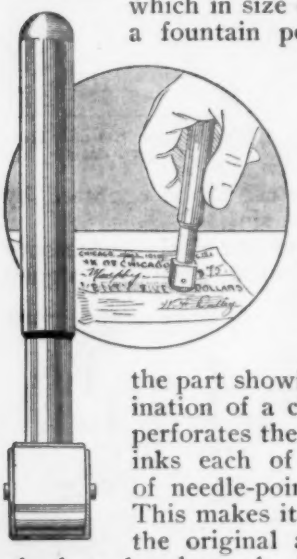


Holder for Ball of Crochet Cotton

To prevent balls and spools of crochet cotton from becoming soiled or tangled while in use, a simple holder has been devised for the sewing table. It allows the material to be unwound as it is required.

CHECK RAISING PREVENTED BY POCKET INSTRUMENT

To make the fraudulent raising of a bank check impossible, a new perforating device has been invented which in size corresponds to a fountain pen and which also serves to identify its owner. The instrument is provided with a series of small, toothed wheels which, when rolled over the part showing the denomination of a check, not only perforates the paper but also inks each of the hundreds of needle-point impressions. This makes it impossible for the original amount of the check to be changed. The wheels of the device are capable of being set to make various patterns of perforations. This enables the recording of the instrument at a bank so that its impressions are as distinctive to a banker as the signature written on a check. It also makes it possible for the device to be used by its holder as a means of personal identification when a specimen of its perforating is shown on a certified card.

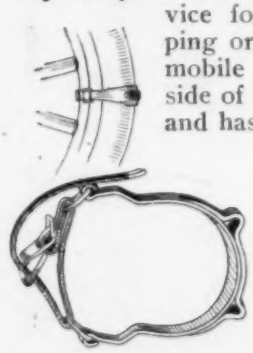


NEW PROCESS FOR STUDYING MICROSCOPIC PARTICLES

A glimpse of the inconceivable smallness of the particles that compose material substances is given in the results of a new process, invented by a German scientist, in which is used much the same method for examining the material as that employed in counting the corpuscles of the blood. The material is first reduced to a fine powder and is then mixed with a measured quantity of some such material as glycerin or oil, the whole being shaken until thoroughly and evenly mixed. A minute quantity of the mixture, usually .01 cubic centimeter (about .0006 cu. in.), is then taken and diluted to one cubic centimeter (about .06 cu. in.). From this diluted mixture a single drop is taken, placed under the object glass of a device used in counting blood corpuscles, and subjected to a magnifying power of 550 diameters. The particles of the material being investigated are then easily counted. With this process it is possible to calculate closely not only the number of particles in a cubic centimeter or a cubic inch of the material, but to determine the degree of fineness to which it has been pulverized. In examining heavy spar that had been finely ground, one gram (about $\frac{1}{28}$ ounce) was first found to contain 4,500,000,000 particles. After regrinding, the number rose to 12,000,000,000, and with a third grinding to 18,500,000,000. A sample of lampblack was found to contain 960,000,000,000 particles per gram.

STEEL TIRE SHOE PREVENTS SLIPPING AND SKIDDING

A tire shoe made of spring steel, $\frac{1}{8}$ in. thick, and fastened over the tire by a specially made strap, is the latest device for preventing slipping or skidding of automobile wheels. The inside of the shoe is smooth and has rounded edges so that it cannot injure the tire, while the traction face is so shaped as to give the shoe a horseshoe hold on the road. The strap is made of waterproof webbing that is said to be stronger than leather. Four of these shoes are ordinarily used, distributed evenly around the rim.



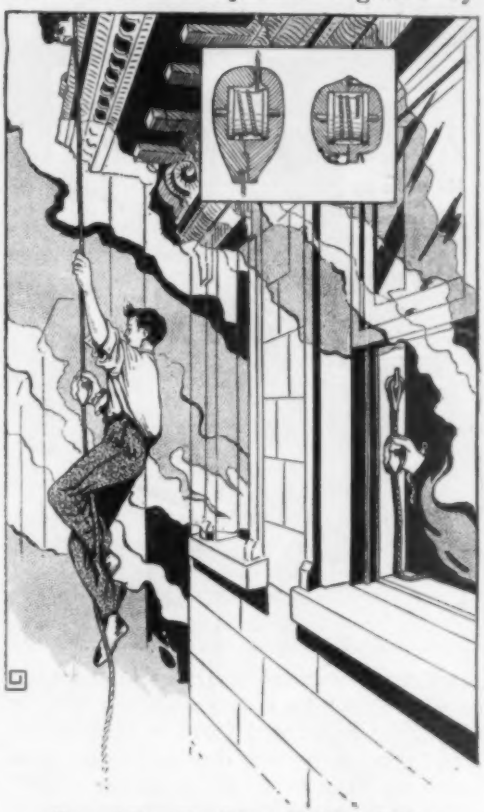
¶One of the largest plants in the world for the dressing of sealskins is being established in St. Louis.

REINDEER SUPPLANT GOATS IN CLEARING FOREST AREA

An interesting experiment in practical nursery work was recently tried by a Canadian paper concern. An area in the vicinity planted to young evergreens persisted in growing up to hardwood shoots and other undesirable shrubbery. Inasmuch as the evergreens never would be good for paper unless allowed to grow unmolested, it was decided to turn a pair of goats into the territory in hopes of clearing off the objectionable vegetation. It was soon found, however, that tender young shoots of both hard woods and evergreens were equally attractive to the goats' palate, and this discovery promptly ended the trial. Later, as a further experiment, a herd of reindeer domesticated for winter travel in place of dogs, were turned into the wooded region. Their taste proved to be more discriminating, as only the undesired poplar, birch, and maple were touched. Thus a little matter of accommodating palates rendered a considerable service in getting the evergreens freed from the competitive growths.

PULLEY USED AS BRAKE IN ROPE FIRE ESCAPE

A rope-and-pulley fire escape of unusual design has lately been patented. With this type the user grasps an inclosed pulley with his right hand, crawls out of the window, and slides on a rope to the ground, his hold on the pulley checking the rate of descent, and in fact definitely determining that speed. This is possible through the peculiar design of the pulley. Within the shell it consists of an ordinary flanged wheel mounted on an axle in the usual way. The rope used in the descent is looped two or three times around this pulley and allowed to dangle down below, its upper end being attached to some anchor, on the window sill, or within the building. In going down, the rope slips through the pulley shell held by the user and revolves the wheel inside. The two halves of the shell form a brake bearing on the pulley, and the tighter the two halves are squeezed together by



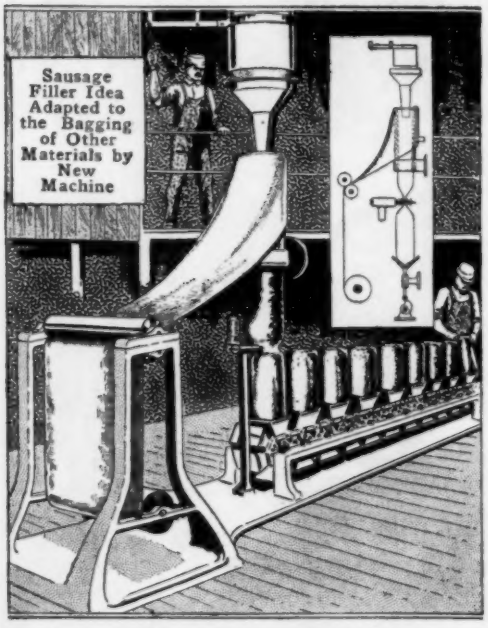
User of New Fire Escape Holds to Pulley in Sliding to Ground

the descending person, the slower the descent. Thus the user has definite control over his speed without tearing his hands on the passing rope. A leather glove with an adjustable wrist strap is provided in order to make holding to the pulley less difficult.

BAGS FORMED AND FILLED IN ONE OPERATION

A western inventor has applied the sausage-filler idea to the bagging of most any material. His contrivance consists essentially of a roll of paper or other bag-making material, which first passes through a forming device. During the process of shaping the bag, the latter is being filled with the grain, or other similar substance, to be

sacked. The shaping operations are accompanied by an interesting side-sewing process, or side-gluing process when the material is paper. The sew-



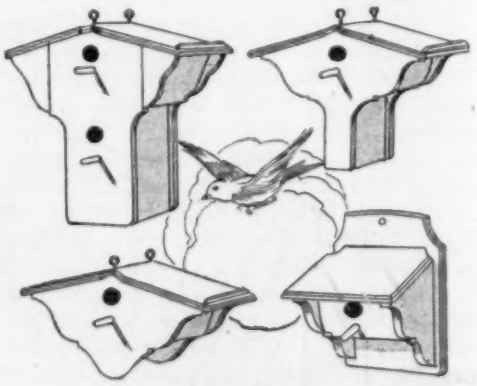
ing machine which operates in the case of cloth has to work with its needle vibrating back and forth horizontally, since the cloth runs down through the machine in a vertical direction. Still another sewing, or gluing, machine takes a reef at proper intervals in the tube as it is being made and filled in the forming device. The result is a series of sacks strung together not unlike sausages. It is only necessary to cut the connecting links, whereupon the machine sends forth a procession of filled and tightly bound packages.

UNUSUAL RECORD IS MADE BY TOURING CAR

Carrying five passengers along the Pacific highway, a six-cylinder motor car made a remarkable nonstop run of 2,050 miles in going from Tia Juana, Mexico, to Vancouver, B. C. Neither the engine nor the wheels were stopped once during the entire trip. The radiator was filled at the start and not again touched until the destination had been reached. At one point it was found necessary to use chains and these were slipped on the rear wheels while the machine was in motion. The run was made in 124 hours and 20 minutes. On several occasions detours were made in order to avoid stopping the car. In passing the Columbia River between Washington and Oregon, a railroad bridge was crossed. When mealtimes came four members of the party ate while the fifth remained at the wheel, driving around a town or running in a circle until the others finished their repasts and he could be relieved. The success of the novel test was partly due to excellent driving, good luck with the tires, and carefully laid plans.

TELEPHONE CABINETS MADE INTO BIRD HOUSES

Wooden telephone cabinets that have been made practically unsalable by the advent of the steel battery cabinet and the desk telephone, are being utilized by one manufacturer for the making of bird houses. The houses are made in four types—the apartment, Swiss chalet, bungalow, and



The Four Types of Bird Houses That are being Made from Wooden Telephone Cabinets

shanty types. Each house is made with openings of the right size to suit the particular class of bird that is to occupy it.

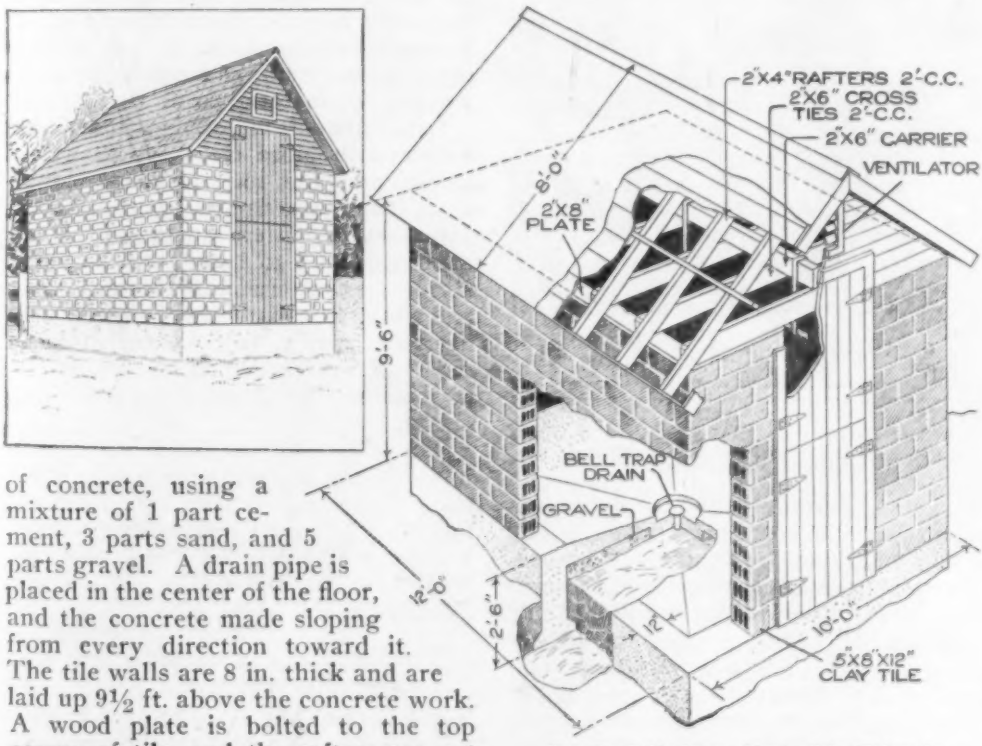
A Hollow-Tile Ice House

By W. E. FRUDDEN

THERE is one kind of material that makes a good wall for an ice house and that is hollow tile. The plans shown are for a house to hold 25 tons, the amount consumed by the average family for one year. This size makes an excellent one for the farmer. Ice stored in a tile structure of this kind will keep during the hot summer months without much loss, and it makes a building of a permanent nature.

The floor and foundations are made of concrete, using a mixture of 1 part cement, 3 parts sand, and 5 parts gravel. A drain pipe is placed in the center of the floor, and the concrete made sloping from every direction toward it. The tile walls are 8 in. thick and are laid up 9½ ft. above the concrete work. A wood plate is bolted to the top course of tile, and the rafters are cut and spiked to it as in ordinary building construction. A crosstie is nailed to each pair of rafters on the plate for use in supporting the ice-carrier track. The gable ends are of frame with ordinary barn siding, and the roof is covered with shingles fastened with galvanized nails. A ventilator is placed in each gable to provide a means for letting the excess moisture pass out.

The door, or doors, is built up in three-ply thickness, using a tarred-felt insulator between each layer. The door is best made in two sections, and



The Dead-Air Space Obtained by Using the Hollow Tile Makes an Ideal Construction for an Ice House

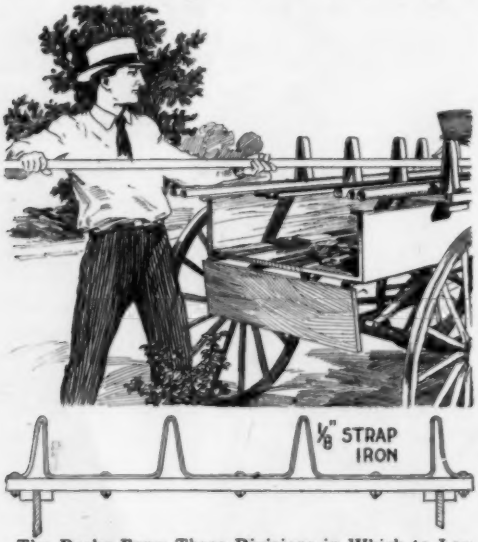
swung on heavy hinges. The frame for the door is constructed of 8-in. plank, and removable leaves are cut to fit the back of the frame, to hold the sawdust and ice away from the door.

To construct this building will require the following materials:

5 bbl. cement.
3 cu. yd. clean sharp sand.
5 cu. yd. coarse gravel.
840 hollow-clay building blocks, 5 by 8 by 12 in.
9 anchor bolts.
2 pieces 2 by 8-in. material, 10 ft. long, for plates.
2 pieces 2 by 8-in. material, 12 ft. long.
7 pieces 2 by 6-in. material, 10 ft. long, for cross-ties.
1 piece 2 by 6-in. material, 12 ft. long, for carrier-track support.
14 pieces 2 by 4-in. material, 8 ft. long, for rafters.
140 ft. 6-in. flooring, for doors.
225 ft. roof sheathing.
2,000 cedar shingles.

Wagon Racks for Hauling Pipe

Plumbers and steam fitters, or anyone having occasion to use a wagon for hauling pipe, will find two such



The Racks Form Three Divisions in Which to Lay the Pipe to Prevent Rolling

racks as illustrated very handy to prevent the pipe from rolling about. The racks, or frames, are made of 2 by 4-in. material with bent iron uprights forming three places to lay the pipe. The method of bending these is clearly shown, and such a contrivance will prove very handy to use, it being a simple matter to toss the frames across the wagon box.—Contributed by Patterson D. Merrill, Chicago.

Clearance of Milling Cutters

In grinding the clearance on the cutting edge of milling cutters, sufficient attention is usually not paid to the angle or exact amount of clearance the cutter will have on the work. This is a very important matter, as too much one way or the other will result in failure on the job.

If the clearance is too great, the cutter will have a tendency to chatter and make a rough finish, to say nothing of the disagreeable noise, and the loosening up of the bolts and clamps on the machine will cause the heel of the land to drag, making an uneven surface, and is liable to break the teeth.

The angle depends, to a great extent, on the diameter of the cutter and also on the material it is to cut, although, in general, milling cutters are used on almost anything that can be cut, from a piece of hard wood to high-carbon tool steel, making regular shapes, such as plain, slabbing, slanting, or angular, while in those that are made up for a special job and used for that purpose only, more attention must be given to the kind of material to be cut.

Generally soft materials will machine better with more clearance than tool steels, and the like, although conditions may cause the reverse to happen. Usually, for cutters up to 4 in. in diameter, from 6 to 7 deg. will be found ample on the outside diameter. Over and above this diameter, the angle may decrease, say, ¼ deg. for each 1 in. in diameter, until 4 deg. is reached, which is about the minimum amount for any cutter.

The clearance on the teeth of end mills should be from 2 to 3 deg., when the cutters are used for roughing and finishing. If used for roughing alone, a little more clearance will give better results.—Contributed by A. Dane, Pottstown, Pa.

¶A small piece of rosin stirred into melted babbitt will improve and make it run better. The rosin-treated babbitt will run into places where the plain will not enter.

Filling Pits in Varnish on Pianos

If the varnish on a piano has pitted, fill the pits with a wax made as follows: Melt together ½ oz. of carnauba wax, 2 oz. japan wax, or white beeswax, and 2 oz. of ceresin wax, in a suitable vessel. A good method is to place one vessel inside of another, place hot water in the outside one, and set them both on a stove. This is called a hot-water bath. When melted, add kerosene enough to form a mass like petroleum jelly, when cool. This may be tested by placing some of it on a piece of glass and letting it cool. If it seems too hard, add a little more kerosene. Rub in on the piano with a wool pad, giving two or more applications until the pits are filled.

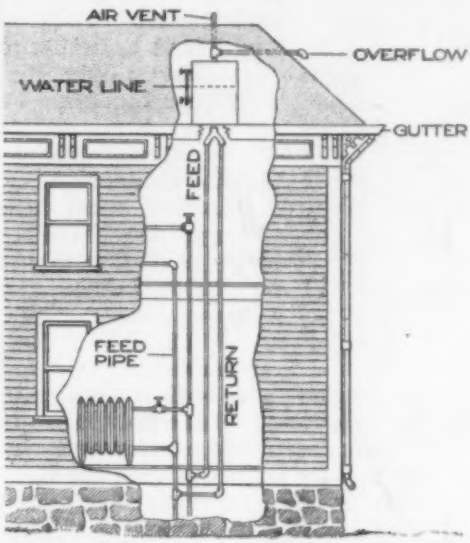
Storing Paint without Waste

In shops where a great deal of painting is done it is difficult to store the paint in such a manner that it will not thicken nor a skin form on the surface. The illustration shows how the difficulty may be overcome. The paint is kept in kegs which are filled and emptied through a spout made of 1½-in. pipe, the end being covered with a pipe cap except when filling and emptying. The emptying is done by rolling the keg on skids to the proper position. By using small kegs, say 10-gal. size, the paint may be shaken up before it is poured.—Contributed by J. J. O'Brien, Buffalo, N. Y.

Skids for a Paint Keg to Make the Pouring Easy and Prevent Waste

Connections for an Expansion Tank

In setting a radiator on the top, or attic, floor, make the connections to the expansion tank as shown, and there will be no freezing of the water contained in it. A free circulation is obtained through the feed and return pipe to the radiator and it will always stay warm. The expansion tank will keep from freezing by installing a Y-connection, as shown.—Contributed by Geo. M. Crawley, Jr., Newark, N. J.



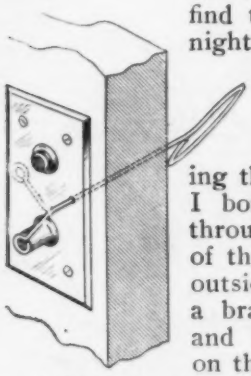
Pipe and Connections to the Attic Radiator and Expansion Tank to Keep the Latter from Freezing

Heating Floor of a Small Shop

The brick floor in my shop is very cold in winter, and to make it more comfortable, I removed the brick and dug a hole, 36 in. long, 18 in. wide, and 18 in. deep, in front of the lathe where I stood most of the time. An old two-burner oil stove was procured and set in the hole. I then covered the hole with a board, made to fit tightly, and bored a number of ½-in. holes near the center. A large hole was also cut in at each side for draft. I was surprised at the results of this little heater.—Contributed by J. H. Priestly, Lawrence, Mass.

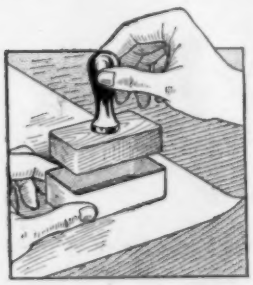
Operating Electric Switch in Hall from Outside

Switches controlling porch lights are usually placed on the inside of the house in the hall. To find the keyhole at night it is desirable to have a light from the outside. To be able to do this without changing the electric wiring, I bored a small hole through the faceplate of the switch box just outside of the box, ran a brass wire through, and turned a ring on the outside end and a right-angled bend with a small ring on the inside end. I can now turn the wire until the inside arm is over the button and by pulling it turn the light on. By locating the hole the same distance from both buttons, the lights can be turned off in a like manner from the outside.—Contributed by J. Maynard, Cleveland, Ohio.



Guide for a Rubber Stamp Used on Tracings

When using a rubber stamp on tracings, a certain amount of time is usually wasted in placing the stamp in the right position. A guide that will remedy this can be made of a strip of tin, or sheet brass, about ½ in. wide, and long enough to go completely around the stamp block. When the ends are soldered together, it should be in the form of a loose-fitting frame. If this frame is laid accurately on the spot to be stamped, the impression will be in the correct position. — Contributed by Frank L. Matter, Portland, Ore.

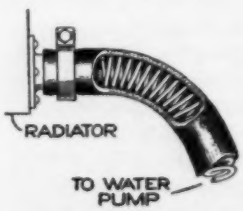


How to Carry a Large Glazed Window Sash

Having occasion to convey a heavy glazed sash for a window that was 3 by 4 ft. about half a mile, and not wishing to call a dray, I carried it in the following manner: I ran the chain off the sprocket wheels of my bicycle and drew it up alongside of the rear fork and tied it to the saddle. Resting the sash on one of the pedals and leaning it against the frame of the bicycle, it was easily and quickly conveyed to the desired spot.—Contributed by Dr. F. G. Swartz, Croswell, Mich.

Reinforcing a Rubber Hose

The radiator, as well as the motor, on one of the automobiles in a garage heated very badly, and it was found that a flattened hose was choking the water circulation. The hose had a sharp bend, as shown, which accounted for its being distorted. It was necessary to reinforce the hose in such a manner that it would keep its shape. To do this, a helical coil was made of 1/16-in. steel wire of a pitch diameter slightly larger than the inside of the hose. The purpose of making it larger was to enable it to be sprung into the tube. A tube, if reinforced in this manner, can be bent into any shape desired, and the opening will remain the same.

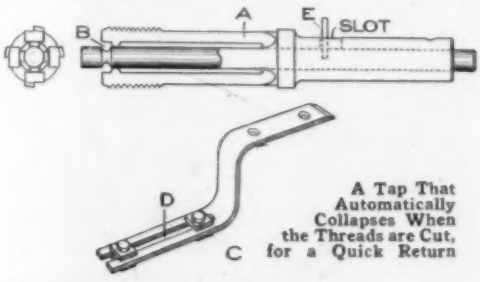


Automatic Tap for High-Speed Work

The tap was designed for use by automobile manufacturers, and others, using a thread of very fine pitch, such as 24 threads to the inch. The tap is readily set for tapping to any depth, and when the desired depth is reached it automatically collapses, thus enabling a quick return. Upon being raised out of the tapped hole, the tap automatically expands to size.

As shown, the tap is set for cutting the thread. The cutting teeth are carried on the ends of the spring arms A, and on the under side of the spring arms is a lug fitting into B, causing the collapse, or release, of the cutting teeth from contact with the thread. The bracket C is secured to the main spindle bearing of the drill press, and in the slot D the pin E moves.

In use, the tap is set in a drill chuck, and the work is placed on the table of the drill press. The work is then raised as near the tap as possible, and the drill started. The tap is run down in the hole and upon reaching the depth for which the dogs have been set, the pin E comes in contact with the lower dog and is delayed, thus stopping the collapsing rod; and as the tap continues, the lugs spring into the groove B, collapsing the tap. The tap is then raised, and when clear of the hole, the pin E strikes the upper dog, delaying the collapsing rod again in its upward movement, and pulling the tap into the cutting position.



A Tap That Automatically Collapses When the Threads are Cut, for a Quick Return

Holding Thin Disk or Ring in Chuck Jaws

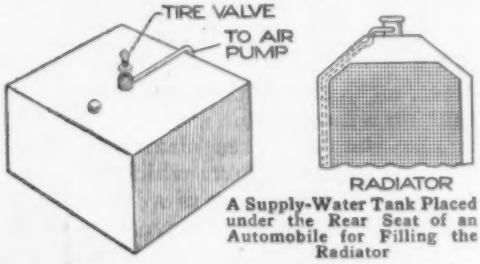
When holding a thin disk, or ring, in the outer end of the jaws on a self-centering chuck, while boring or facing work, it is almost impossible to keep the surface true without something between the disk and the jaw. This may be accomplished by attaching a small ring, as shown in the illustration at A. It will be observed that the heavy ring is resting on the light one, which has an opening in it, to keep the ring a short distance away from the working surface and provide clearance for the boring tool as it passes through. A similar chuck, holding a ring on the outside of the jaws, is shown at B. In this case it is not necessary to reverse the jaws to turn the rings on the outside, which saves time and trouble.

A Ring Placed Back of a Disk being Worked in a Chuck to Keep the Surface True

Supply-Water Tank for an Automobile Radiator

To prevent the engine in my automobile from overheating and to do away with the necessity of stopping for water on long trips, I installed a separate water tank by which the radiator can be filled at any time without having to stop. The general construction of the device is as follows: A 5-gal. galvanized-iron tank was installed under the rear seat, an outlet was made at the bottom, and pipe connections were run to the top of the radiator.

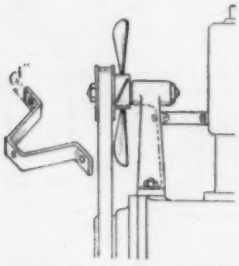
Two holes were made in the tank top for pipe plugs, one of which was drilled and fitted with a tire valve. Pump-hose connections were made from the tire valve to an air pump conveniently located at the driver's seat. The other plug was used for filling the tank. A valve was placed where it could be easily reached, in the water line running from the tank. It is only necessary to pump a little air in the tank and open the water valve to fill the radiator.—Contributed by Harry Gahan, Victoria, B. C.



A Supply-Water Tank Placed under the Rear Seat of an Automobile for Filling the Radiator

Making an Automobile-Engine Fan Bracket Rigid

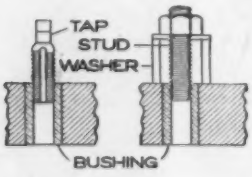
The bracket supporting the cooling fan on an automobile engine became very loose, due to the insufficient base and holding power of the studs. This caused the fan to make a disagreeable noise when in operation, and a repair became necessary.



A piece of strap iron, 3/16 in. thick and 1 in. wide, was bent to the proper shape and fastened with studs to the bracket and to the cylinder wall. The studs used in the cylinder wall were coated with white lead to prevent any leakage. Upon fastening the bent piece of metal between the bracket and cylinder a rigid support was obtained and the trouble eliminated. — Contributed by Adolph Kline, New York City.

Removing Small Bushings

Having occasion to remove a number of small brass bushings from certain parts of a pneumatic motor, I found them so placed that it was impossible to drive them out without damaging other parts. While they could have been chipped and broken down to remove them, it was not expedient, as that would occasion a loss of time on a hurry job.



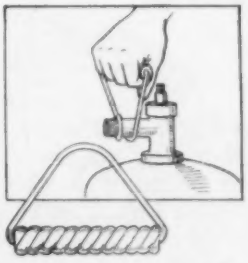
The sketch makes clear a method used to get them out, which also can be applied in any case of a like nature. As the bushings were worn to a point of uselessness, a tap was run down into them deep enough to make three or four threads. A stud was then inserted, and by means of a large washer and nut of the same size as the stud, the bushing was easily drawn from the body of the device by turning the nut. This makes a safe and easy way for drawing bushings in a machine where it is impractical to force or draw them out by other means.—Contributed by F. W. Bentley, Missouri Valley, Iowa.

To Prevent Oil Sticking to Lubricator Glasses

To keep the inside of a lubricator glass free from oil, dissolve a very small piece of soap in the water. This will make the glass slippery and prevent the oil from adhering to the glass. A piece of soap put in the glass about once a week, will be sufficient to keep the glass always clean.—Contributed by Harry Piel, North Bergen, N. J.

Carrying Handle for Acetylene-Gas Tanks

Tanks containing compressed acetylene gas are not convenient to carry, and for this reason I made a handle as follows: A piece of heavy wire, or leather thong, is run through a piece of pipe or flexible tubing, used for insulating electric-light wires, and is applied on the valve end of the tank. This makes it easy to carry the tank just the same as a pail.—Contributed by E. K. Marshall, Oak Park, Ill.



Glass as a Substitute for Tracing Cloth

Instead of using tracing cloth, or paper, in instances where the tracing is not to be kept as a record, a plain sheet of glass makes a good substitute, and one that possesses certain advantages. Take a plain piece of glass that is perfectly clean and dry, and it will take the drawing ink perfectly, and no sizing need be used. The ink dries as

quickly as on paper, and when dry, the tracing may be dusted or wiped off without the slightest injury to the tracing.

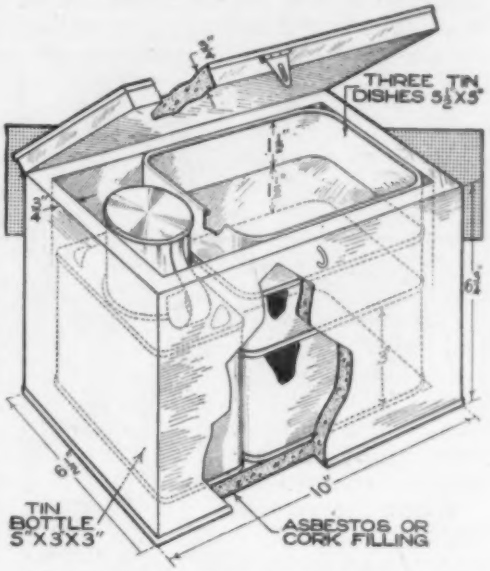
When the tracing is no longer wanted, a damp cloth will quickly remove the ink, and the glass is then available for another tracing. The centers are located by means of a small piece of rubber, leather, or the like, moistened and placed on the glass. This gives a good rest for the point of the compass. This idea simplifies the blueprinting work, as it does away with tracing cloth, and a single glass will do for many tracings, besides which the glass always lies flat, without the use of thumb tacks, and the finest line is readily seen. It will not draw and wrinkle when the air is humid and cause a defective blueprint.

A Hot-Dinner Pail

This is simply an adaptation of the fireless-cooker idea, changed only in size and thickness of the insulating sides. It is not guaranteed to keep food as hot as liquid in a vacuum bottle, but will, if properly used, serve the dinner appetizingly hot.

The drawing is self-explanatory. Tin is the best material both for the inner and outer sides, as well as for the three food decks and a square tea or coffee bottle. The filling between the two shells may be the best nonconductor that can be had, but sheets of solid cork offer the lightest and easiest-worked filling. After the insulating material and the inner shell are in place, the upper edge of the box is covered with a ¾-in. strip of tin, soldered neatly. The lid, swinging on soldered hinges and fastened down by a catch, strap, or any other convenient method, is simply a ¾-in. deep tin box, 10 in. long by 6½ in. wide, filled with the nonconducting material.

The decks and bottle are made with round corners, excepting the angles of the sides with the bottom, which are left square. The upper edges of the sides being rolled inward, any dish will stand firmly on top of any other one inside of the box. In practice, the decks containing the hot food are first placed in position and pushed snugly



Pail Made Like a Fireless Cooker to Keep Edibles Hot until Lunch Time

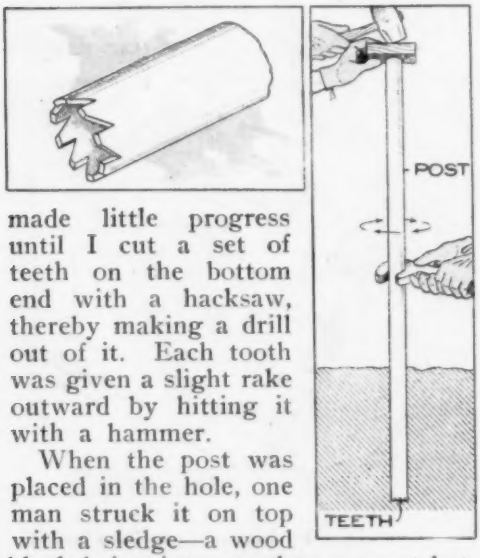
against one end. The bottle is then set in, locking the decks in place. When lunch time comes, the bottle, of course, is first lifted out by the lugs soldered on its shoulders for that purpose, and the food decks are released. It may make the description of the decks a little more clear to state that they are just like large sardine boxes.

The dimensions given are intended to be merely suggestive and may be varied within reasonable limits. In fact, the idea lends itself to a number of variations from a simple individual two-deck kit to large boxes for automobile touring parties. Provision is easily made for carrying knives, forks, and spoons either inside or out.—Contributed by A. M. Parker, Edmonton, Canada.

¶To oxidize brass and copper objects, use the following solution: Nitrate of iron, 2 oz.; hyposulphite of soda, 2 oz., and water, 1 pt. Immerse the object in this solution and leave it until the desired depth of color is obtained.

Making Post Dig the Post Hole

In planting a piece of 1½-in. iron pipe for use as a hitching post, I tried to drive it into the frozen ground, but

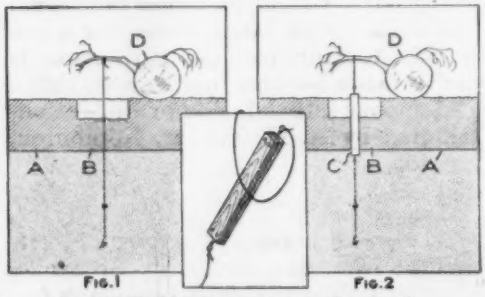


made little progress until I cut a set of teeth on the bottom end with a hacksaw, thereby making a drill out of it. Each tooth was given a slight rake outward by hitting it with a hammer.

When the post was placed in the hole, one man struck it on top with a sledge—a wood block being interposed to prevent battering—while I turned it with a pipe wrench. In this way I anchored the post quickly and firmly, as the teeth cut out the core of frozen earth just wide enough to receive the post. The core, of course, was forced up into the pipe.—Contributed by James M. Kane, Doylestown, Pa.

Protecting a Fish Line in the Ice

In fishing with lines through the ice the lines are often frozen during the



Boards Nailed over a Line to Protect It When Cutting Out the Ice

night, and frequently, when chopping the ice from around them, the lines are cut. The section A shows the ice, and B is the ice frozen in the hole during the night. A line holder is shown at D. To protect the line, I use two boards, C, nailed together over the line. If these freeze in the hole, it is an easy matter to chop them out without injury to the line.—Contributed by Geo. Goodwin, Jr., North Temiskaming, Quebec.

Weight, Power, and Speed, and the Light Automobile

The automobile-buying public takes in the various "arguments" put forth in favor of different cars as salesmen's talk and disregards some very important points in just this way, little guessing that a short period of use of the cars will prove many of the arguments to be truths backed up by indisputable principles of physics and engineering.

Consider, for instance, the arguments for and against the "light car." The light-car salesman claims more speed, more power, less fuel consumption, better hill-climbing qualities, and more carrying capacity, together with many other things that need not be mentioned. From an engineering standpoint the foregoing claims may be resolved into these factors: power, speed, and weight.

As an example, consider an engine of 30 h.p. It will move a light load farther than a heavy one, as with every increase of speed an increase of power in direct proportion is required; or to put it in another way, the power supplied remaining constant, the speed depends upon the load or weight that is moved. Naturally, it follows that a light car will go faster, uphill or on a level, than a heavier car of the same engine power carrying the same passenger weight. Also, the light car can go farther with one passenger than it can with five, the same being true of the heavy car as well. Hill climbing is merely raising a weight to a certain height, and the load it imposes upon the engine may simply be considered

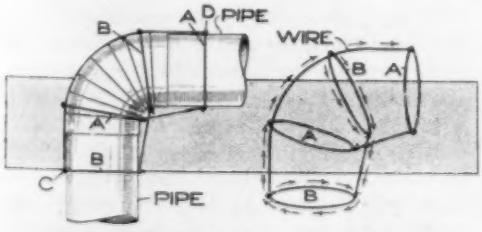
another weight. The engine has then three weights to move: weight of car, weight of the passengers, and the "weight" of moving both uphill. If any one is lessened, or removed, the engine can move the remainder at a higher speed. Or to get a higher speed is an impossibility without a decrease in weight.

As the weight of the car is a part of the load the engine must move, the light car can be run by a smaller engine, or by less overloading of the same engine; hence the lower fuel consumption of the light car carrying the same passengers.

First, the power required is directly proportional to the weight and the speed with which it is moved; second, the weight that can be moved is directly proportional to the power applied and the speed with which it is moved, and, third, the speed is directly proportional to the weight moved and the power applied. Other factors enter into car service, but the foregoing statements should be kept in mind. Measured by them alone, the light car has many advantages.—Contributed by Donald A. Hampson, Middletown, New York.

To Keep a Stovepipe Connected

The elbow is usually the first part of a stovepipe to pull loose where there is a long line. If, however, two loops of wire are twisted tightly around the pipe joints, at A and B, and also in the

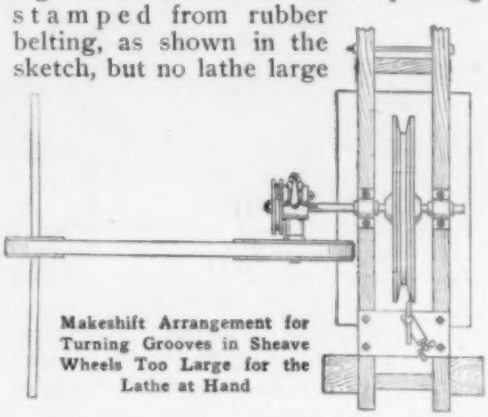


Tying the Elbow of a Stovepipe to Prevent Dislocation in a Long Line of Pipe

grooves of the elbow, then secured by the wire backbone from C to D, the danger of dislocation will be much lessened.

Turning Large Sheave Wheels without a Lathe

Having a number of V-groove, 7-ft. sheave wheels that required machining to receive a dovetail packing stamped from rubber belting, as shown in the sketch, but no lathe large



Makeshift Arrangement for Turning Grooves in Sheave Wheels Too Large for the Lathe at Hand

enough to swing them, I devised a temporary arrangement to do the work, as follows:

Two large timbers were placed over the motor pit, which lay parallel to the line shaft, and spreaders inserted between them and bolted together. They were braced sideways and the sheave wheel hung on an axle running in bearings attached to them.

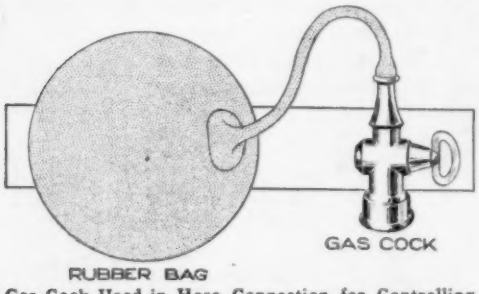
The hand chain wheel was removed from a 2-ton chain block and a 14-in. pulley put in its place. The left chain wheel was removed and the square end of the shaft was inserted in the square socket previously cut in the end of the sheave-wheel axle. The chain blocks were fastened with a couple of large 7-in. bolts to a timber 12 in. square.

A heavy steel plate was then placed across the timbers in front of the sheave wheel, on which was mounted the extra tool-post head of the lathe. With this arrangement the speed was reduced and sufficient power obtained for practical work.—Contributed by H. V. Abeling, Burke, Idaho.

¶A lemon that has been squeezed for cooking purposes is still just the thing for cleaning the brass of lamp burners, etc. Add a little salt, and the black will come off easily.

Controlling the Inflation of a Gas Bag

What is known to mechanics as "bagging a pipe" is the insertion of a deflated rubber bag into a water or gas



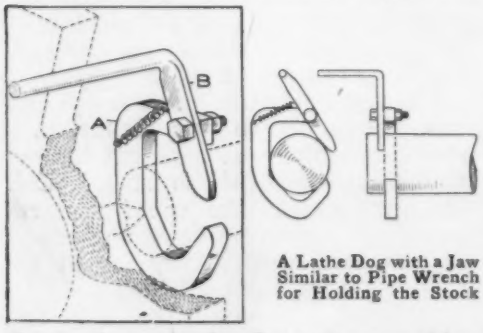
Gas Cock Used in Hose Connection for Controlling the Inflation of a Gas Bag in a Pipe

main. The bag is inflated through a rubber tube attached to it. This inflation effectually prevents the passage of gas or liquid through the pipe.

Some mechanics attach a gas cock to the tube. The air hose is screwed into this cock, and when the bag is sufficiently blown up, the key is closed. This does away with the necessity of doubling the hose and tying it, as would have to be done if the gas cock were not used. It also permits an easy renewal of inflation.

A Quickly Applied Lathe Dog

In roughing down a large number of shafts prior to grinding them, I found it took considerable time to adjust the

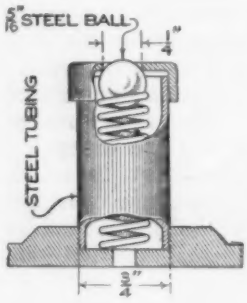


A Lathe Dog with a Jaw Similar to Pipe Wrench for Holding the Stock

dog and remove it. I set about making one as an improvement over the ordinary lathe dog and one that could be quickly applied, and the result was as illustrated. The body, or yoke, A, was made of machine steel, 2¾ in. long, 2 in. wide, and ¾ in. thick, which was casehardened after it was forged into the shape shown. The tail B, on which a notched end was formed for holding the shaft, was made of tool steel and tempered. The tail swings on a pivot in the extending end of the yoke. A helical spring is placed in a drilled hole, as shown, to open the dog for removal. When driving the shaft it grips tightly the same as a pipe wrench.—Contributed by Jos. Pruell, Walpole, Mass.

A Homemade Oil Cup

The oil cup illustrated can be made from scraps of material found about most shops. The body consists of a piece of steel tubing, threaded on both ends and turned into the thread of the bearing. The upper end is covered with an ordinary pipe cap, which is previously drilled with a ¼-in. drill. A steel ball, 5/16 in. in diameter, and a helical spring, placed on the inside of the tube, complete the cup.

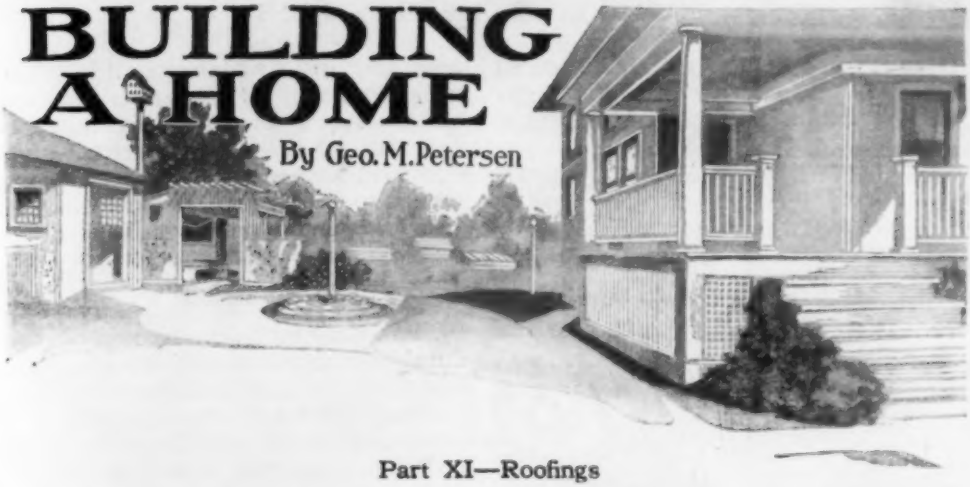


Marking Tools by Electricity

While trying to find some effective way of marking my tools, I tried the following method, which worked satisfactorily. I connected one side of a 110-volt circuit to one terminal of a toaster, joined the other terminal of the toaster to the metal of the tool to be marked, and fastened a piece of lead pencil to one end of a piece of wire and connected it to the other side of the line wire. By lightly tracing my initials on the tool with the lead pencil, an indelible and clearly legible identification mark was made.—Contributed by Henry Worthmann, Jr., Chicago.

BUILDING A HOME

By Geo. M. Petersen



Part XI—Roofings

THE subject of roofings is one on which experienced builders and contractors differ, it being very seldom brought up in a gathering of these men but that a lively argument will be the result. For this reason only facts concerning the different roofing materials will be given, without recommending any one of them. There are numerous kinds of roof coverings in use at the present time that are giving satisfactory service. They are shingles, slates, asbestos shingles, asbestos corrugated sheets, metal shingles and tiles, tin, tile, gravel, prepared or ready-made roofings of numerous kinds, corrugated iron sheets, and canvas. While some of these roofings are only used for garages, veranda decks, dormer roofs, etc., yet they are roofings and will be treated as such.

Shingle Roofs

Shingle roofs, when properly laid, give very fair service for from 10 to 20 years. In the old days when the shingles were split from a piece of straight-grained timber, it was nothing to be marveled at if a shingle roof lasted 60 years, or more, but the modern shingle is an entirely different proposition to handle. Practically all of our shingles today come from the state of Washington and are known as the Washington red-cedar shingles. They are cut from the butt of the log, the grain being reversed in every other one, as shown in Fig. 1. The shingles are then bundled and kiln-dried to get out the last bit of moisture so that the freight rate to the central and eastern states will not be excessive. Many times stumps which have been dead for 5 or 10 years are cut over and made into shingles. Even though the stumps are dry, the shingles are kiln-dried after being cut, and still it is wondered why a shingle will split so easily in the hands.

Shingle roofs, bad as they are for lasting qualities, are comparatively cheap in cost and maintenance, and, when properly laid, give value for the amount expended. The common expression that anyone can lay shingles is a mistake. Anyone can put shingles on a roof, but it is almost certain that they will pull up or split so that the roof will leak. This will not be the fault of the shingles, but of the person that laid them. It may cost a few dollars more to do it right, but it will pay in the end.

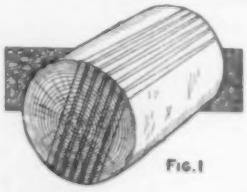


FIG. 1

A good shingler looks at the butt of the shingle and then lays it on the roof, as shown at A, Fig. 2. If this shingle has any tendency to warp or curl it will be downward, as shown at B, and will keep the roof tight. If the shingle is laid as shown at C, the result will be as at D. Shingles should never be laid that are more than 7 in. in width,

as they will expand and contract so much as to cause cracks in them. At least ⅛ in., and preferably ¼ in., must

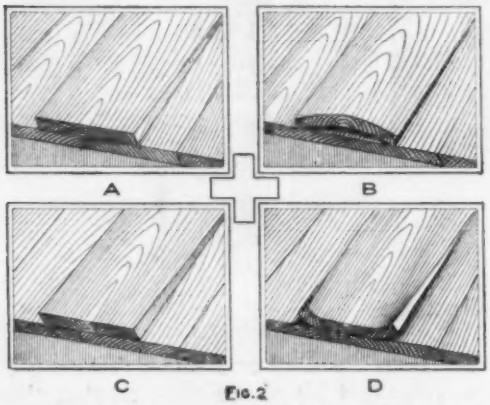


FIG. 2

Proper and Improper Method of Laying Shingles to Make Them Lie Flat or Warp

be allowed between shingles for the expansion in wet weather, and for the same reason shingles must be fastened with only one nail to prevent splitting. The nail is placed near one edge, and in such a position that the overlapping shingle in the next course will just about cover it. The nails commonly used are four-penny cut, galvanized or zinc. Shingles should never be laid with joints over each other in the alternate courses, but as shown in Fig. 3, and never more than 5 in. to the weather, 4½ in. being much better. A

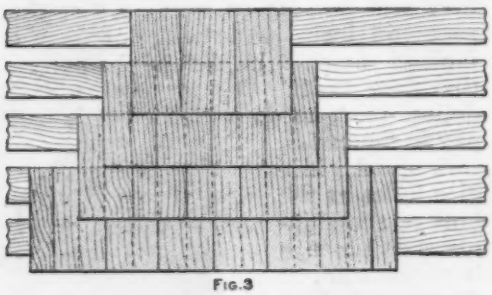


FIG. 3

Shingles Laid so That the Third-Course Joints will Not Coincide with Those of the First

section of a shingled roof is shown in Fig. 4.

Wood shingles may be preserved and tinted by dipping them in a mixture of creosote oil and crude oil, half and half, with a little color added. The creosote is the preservative, but it is quite hard on colors, and for that reason, and for the sake of economy, the crude oil is used. Creosote alone will give the shingles a dark-brown stain, while the mixture of both oils produces a light-brown color.

Slate Roofs

Plain-slate roofs, on account of their durability, fire-resisting qualities, and color effects, are probably the most common for the medium-priced home. Some of the colored slates cost as high as $18 per hundred square feet, which is termed a square, and this price is a little too high for the medium-priced home. While the average cost of shingle roofs is about $7 per square, with material and labor furnished by the contractor, the cost of good slate roofs will average about $10 per square, although a grade of slate which is soft and shaky can be obtained for about $8.50 per square. Of course, the price given is in addition to the cost of the lumber required for the roof boards, as slate should be laid over a matched-board roof. A section of a slate roof, Fig. 5, and a comparison of Figs. 4 and 5 will readily show which is the more expensive as far as the carpenter labor is concerned.

There are so many grades of slate that it may be best to give the gradings as used in Bangor, Pa., where the best slate is mined. A pure slate without any faults or blemishes is known as No. 1, clear. The No. 1, ribbon, is as well made as the No. 1, clear, but contains one or more ribbons which are high enough on the slate to be covered when laid, thereby presenting a No. 1 roof when finished. A ribbon is a black band, or streak, across the slate. The No. 2, ribbon, contains several ribbons, some of which cannot be covered when laid. The No. 2, clear, is without ribbons, but made from rough beds. The hard beds are a clear Bangor slate, not quite as smooth as the No. 1, clear, but much better than a No. 2, clear.

The size of slates range from 9 by 7

in. to 24 by 14 in., with about 35 intermediate sizes. The thickness of the slates may vary from ⅛ in. to ¼ in., with the better grade all 3/16 in. thick. The large-size slates are the best adapted for plain roofs, as they make fewer joints, avoid small pieces at the valleys, and require a less number of nails.

A good slate should be both hard and tough. If the slate is too soft, the nail holes soon become enlarged, and allow the slate to work loose and blow away. If too brittle, the slate will fly to pieces in the process of "holing," and will be easily broken on the roof. Slate may be tested by rapping it sharply with the knuckles, producing a sharp metallic ring. The slate should break, but not splinter under the slater's ax, and should not be "tender" at the edges. Up to a few years ago, the slates were punched on the job, but at the present time the slate is holed and countersunk at the quarry, when so ordered. This latter method is much better, as the old way often damaged the slate.

The regular colors in which slate can be obtained are black, green, red, purple, dark blue, and gray. While the color does not necessarily affect the wearing quality of the slate, it sometimes shows the slate to be soft or from a new quarry. The deeper the quarry the harder the slate, and usually the darker the color. If a slate stands the knuckle test, it is pretty safe to put on the roof. The colors most in demand for residence work are black, light green, mottled purple, and red, and there are very few greens and reds that will not fade in time. The dark-purple slates sometimes have a large spot of light green on them, which, while it seldom affects the durability of the slate, greatly detracts from its appearance.

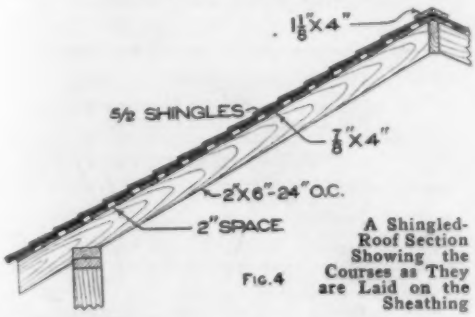


FIG. 4 A Shingled-Roof Section Showing the Courses as They are Laid on the Sheathing

Slate should be laid over a tight board roof, covered with tar paper or felt. Each course of slate should lap the preceding course by at least 3 in., and should be fastened with a three-penny or four-penny nail in each upper corner. Zinc, copper, galvanized, or tinned, nails should be used. Common nails will rust away quickly and allow the slate to be blown off the roof. If the expense can be met, it is advisable to use copper or zinc nails, and copper flashings. This will take care of all roof troubles for years to come. Roofs to be covered with slate should have a rise of at least 6 in. to the foot for large slates, and 8 in. to the foot, for the smaller ones. In really good work, the top course, the three bottom courses, and 1 ft. each way from all valleys and hips, should be bedded in elastic cement. Slates 3/16 in. thick will weigh about 650 lb. per square on the roof.

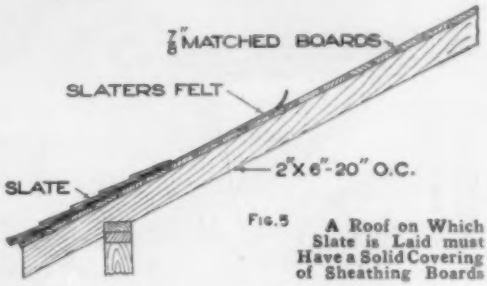


FIG. 5 A Roof on Which Slate is Laid must Have a Solid Covering of Sheathing Boards

Asbestos Shingles

Practically all articles and materials used in building which are regarded as "standard" owe their origin and existence to some necessity. This is the case with asbestos shingles. The demand was for a material stronger than wood shingles, lighter than slate, and cooler than either. The remarkable heat-insulating qualities of asbestos shingles make them an ideal roof for the southern states.

Asbestos shingles are composed wholly of asbestos fiber, 15 per cent,

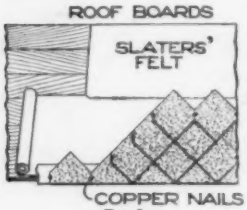


FIG.6

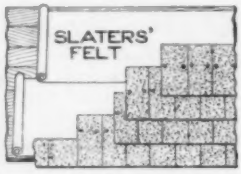


FIG.7

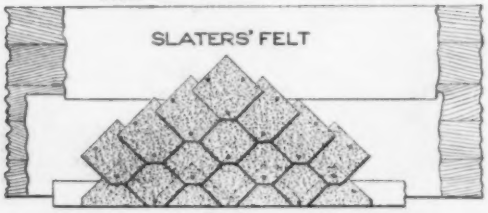


FIG.8

Three Methods of Laying Asbestos Shingles: The Diagonal, Straight, and Honeycomb

and Portland cement, 85 per cent. The mixture is combined with a sufficiently large volume of water to bring the cement into a colloid state, and then subjected to a pressure of about 650 tons to the square foot. The result is a smooth shingle of even thickness, which is not only light-weight, but resists fire absolutely. These shingles are $\frac{3}{16}$ in. in thickness, and of various sizes and shapes, and are laid with copper storm nails that will never rust off.

The diagonal method of applying these shingles is shown in Fig. 6, the straight-laid, in Fig. 7, and the honeycomb, using a square-cut corner, in Fig. 8.

These shingles may be obtained in various colors, the principal ones being gray and red. The gray shingles, laid with a red belt and red asbestos ridge, will make a roof that will bring forth a favorable comment at all times. Asbestos shingles weigh about 280 lb. per square on the roof.

The cost of asbestos shingles is about $8.50 to $9 per square, depending on the kind of roof, with a slight advance to these prices if red is used. These shingles are put on over a tight roof by carpenters, and the slate roofers are not very keen about recommending a material that can be put on by mechanics other than roofers. In a short time, however, the slate roofers will be forced to take hold of asbestos shingles, and then the general public will get the inside information on a really good product. Asbestos shingles are not an experiment, as they have been used on many buildings throughout this country, as well as on many government buildings, and by large corporations.

Before taking up the subject of the less common roofs, it will be well to consider the advantages and faults of the three principal roofings mentioned. The prospective home builder can quite accurately size up the roofing question, and decide for himself which one is the best suited for his needs, by the following table:

Material	Advantages	Faults
Wood shingles.....	Low initial expense. Easy to repair. Not affected by heat. Light in weight. Unlimited color effects by use of stains.	Inflammable, subject to decay and curl. Hot in summer, cold in winter. Subject to mossy growth in damp places.
Slate	Fire-resisting. Not affected by dampness. Large range of color effects. Warm in winter. Well advertised and known almost to every person.	High initial expense. Expensive to repair. Affected by frosts. Hot in summer. Heavy in weight. High expense for color effects. Breakable.
Asbestos	Fire-resisting. Not affected by dampness. Cool in summer. Warm in winter. Not affected by frost. Lighter than slate. Less expensive to repair than slate. Low cost for color effects. Practically unbreakable.	Heavier than shingles. More expensive to repair than shingles. High initial expense. Limited color effects. Not well known except by those in the business.

Asbestos Corrugated Sheathing

This sheathing is made by the same process as the asbestos shingles, and possesses all the advantages of that product. It is used principally for factories, and is mentioned here solely for its use for roofs and walls of garages. If this sheathing is used on angle-iron studs and rafters, the garage will be absolutely fireproof. The method of applying this material on angle-iron rafters is shown in Fig. 9. The material only weighs 3 lb. per square foot, which is about the weight of No. 14 or 15 gauge corrugated sheet iron and steel.

While this material is rather expensive, the small quantity needed for the average garage will not cost very much.

Metal Tile and Shingles

The beauty of Spanish tile is often desired where its great weight would be prohibitive, as it varies from 750 to 1,200 lb. per square. To overcome this disadvantage, the metal-shingle manufacturers have placed on the market the metal tile which closely resembles it, but weighs only slightly more than the corrugated sheet metal. These tiles are slid together, by various means used by the different manufacturers to make the joints tight. Metal interlocking shingles with raised pattern are also being manufactured, although metal roofings have never proven satisfactory.

Metal tile and shingles are a cheap roofing material, considering first cost only, light in weight, and extremely easy to apply, but they are certainly annoying in heavy rainstorms, as the continual tapping of the rain on the roof can be heard. The main fault with metal of any kind is that it corrodes easily. Applying paint on the exterior of the shingles will not protect the under side where the rusting sets in, and thus the life of the metal is very short.

These metal roofings cannot be used on flat, or almost flat, roofs, but only on roofs that have a pitch suitable for shingles.

Tin Roofs

Tin roofs are generally used for flat surfaces where shingles or slate cannot

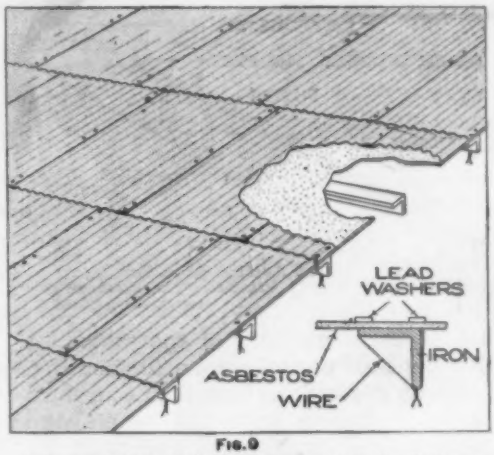


FIG. 9

Asbestos Corrugated Sheathing as It is Applied to a Building Using Angle-Iron Rafters

be used. The sheets are made of soft steel, and sometimes of wrought iron, and are dipped in a bath of tin and lead until the surfaces are well covered. These sheets are designated as "terne plates" to distinguish them from plates coated only with tin, which are called "bright tin."

A number of mills now use a patent roller process for dipping the sheets, whereby the tin and lead is rolled into the sheet so that the coating can be thin, medium, or thick, according to the price obtained for the sheets. As the terne plates are the best, they alone will be considered. They are made in two thicknesses, viz., "IC," in which the iron body weighs 50 lb. per hundred square feet, and "IX," weighing 62½ lb. per hundred. For roofing, the lighter weight is preferable, because the expansion and contraction

FIG. 10

FIG. 11

A Flat Seam Well Hammered Down and Soldered, and the Standing Seam without Solder

is not so great and, therefore, is not so hard on the seams as it would be in the case of the thicker plates. For

gutters, conductors, flashing, etc., the IX plates should be used. The thickness of the iron adds absolutely nothing to the durability of the plates, as this depends entirely upon the coating.

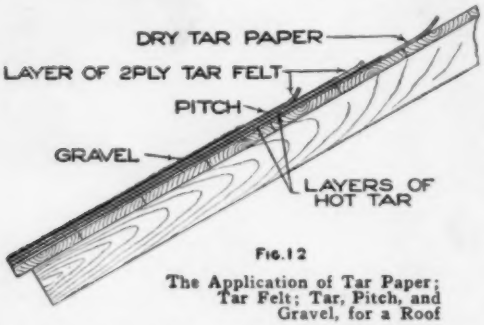


FIG. 12

The Application of Tar Paper; Tar Felt; Tar, Pitch, and Gravel, for a Roof

Roofs made with less than one-third pitch are made with flat seams and preferably covered with sheets 14 by 20 in., since a large number of seams stiffens the surface and helps to prevent buckles and rattling in stormy weather. The metal should be secured with 1-in. barbed and tinned roofing nails, placed not more than 6 in. apart and well under the edge. The seams should be well pounded down with a wood mallet, and sufficient time taken to sweat the solder into the seams properly, as shown in Fig. 10. The owner should see to it that nothing but good rosin is used as a soldering flux, as acid will attack any exposed iron and cause it to rust out in a short time.

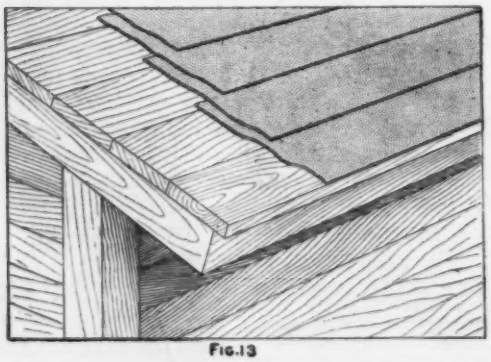


FIG. 13

A Roof Composed of Five Layers of Three-Ply Asphalt-Saturated Felt

A good tin roof will last, if the material is of a good quality and properly put on, for from 30 to 40 years. It should be kept well painted. Tinwork should never be given the first coat of paint until after it has been exposed to the weather for two or three weeks and well washed with rain to remove the grease from the surface. Painting the under side of the tin before laying it will greatly increase the lasting qualities, and if laid on felt paper, the noise will be deadened in a heavy rainstorm. The cost of a good flat-seam roof is about $9.50 per square, and of a standing seam, $9. A standing seam is mostly used on a steep roof and without solder, as shown in Fig. 11. The nails are not driven into the roof, only into the cleats at the seam.

Tile Roofs

Tile roofs, as mentioned previously, are used chiefly for the decorative effect and not for reasons of durability. Roofing tile is very heavy and shows to advantage only on a roof of a building specially designed for it. It is an open question with roofers and architects whether a tile roof is preferable to a No. 1 slate roof or not. At present the slate roof is much more durable, although there are a few makes of tile that, when properly laid, have given good satisfaction.

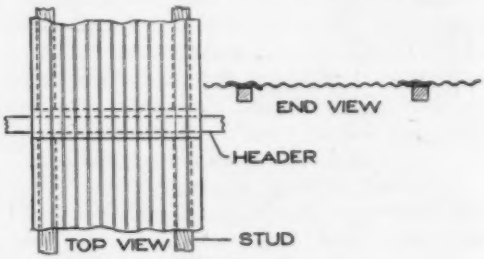


FIG. 14

Method of Applying Corrugated Iron Sheets to a Roof, Showing the Lap on a Header

Gravel Roofs

Gravel roofs are seldom used except on old houses, outbuildings, or flat roofs that would ordinarily require tin. While the gravel roof gives good service and is fairly durable, it is not fit for a new house, or an old one that is of any value, for the reason that a hot sun

will melt the tar and cause it to run into the gutters or drip from the eaves. For a flat roof, however, it is all right, as it cannot be seen over the gutters. In fact, authorities on the subject agree that gravel roof should not have a pitch of less than ⅜ in. or more than ¾ in. to the foot in hot climates, and in no case more than 4 in. to the foot. Gravel roofs should first have a layer of dry tar paper laid over the roof boards, to prevent the pitch from running through the cracks. Over this is placed a layer of hot tar, and then another layer of two-ply tar felt; another layer of hot tar, another layer of tar felt; a layer of pitch, and then the gravel. The tar felt should not weigh less than 14 lb. per square, single thickness, and a three-ply roof should have 70 lb. of tar and pitch to the square, and from 200 to 300 lb. of gravel.

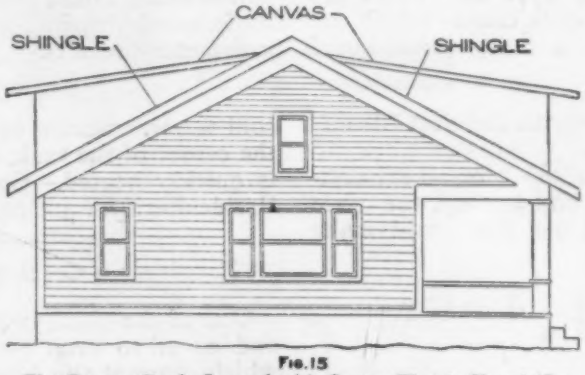


FIG. 13
Flat Dormer Roofs Covered with Canvas That is Shrunk On, Then Coated with White Lead and Oil, to Make It Waterproof

A gravel roof of this kind can be put on for about $3 per square, and if properly nailed with large-head, barbed, roofing nails, it should last from five to seven years. There are numerous methods in vogue, but the one mentioned will give very satisfactory results and is very reasonable in price. A sectional view of this roof is shown in Fig. 12. While this roof is not fireproof, it is fire-resisting, and when the inflammable oil is burned out, it will cause the residue to swell and form a porous, incombustible mass.

Prepared and Ready Roofings

Prepared and ready roofings have been placed on the market to take the place of gravel roofs to a certain extent. These roofings are made of from one to five-ply material, which is nailed on the roof as one sheet. The edges of these roofings are cemented together with a cement furnished by the manufacturers. These roofings are especially useful in repair work, as they can be put on right over the old shingles and save the cost of removing them. They are also valuable near a railroad or factory, where the fire hazard is too great for a shingle roof and the acid fumes from the smoke will corrode metal. They are very easy to apply and are guaranteed by the manufacturers for from 5 to 10 years. Most of these roofings have to be painted every two or three years to make the guaranty good.

The prepared roofing which I have used with considerable success on coal trestles, and buildings of such nature, on which metal roofs cannot stand for more than a few months, is shown in Fig. 13. This roofing is composed of five layers of three-ply asphalt-saturated felt.

When selecting ready roofings, do not pick out those in which fine grit or stone is rolled into the surface, unless there is another layer of felt underneath applied to the roofing after the grit has been rolled in. The reason for this is that the great pressure under which the grit is forced into the felt often forces the tiny points of the material through the roofing, and in a few months the action of the elements will cause the roofing to draw away from the hole, and a leak results. These roofings range in price from $3 per square up, put on the roof.

Corrugated Iron Sheets

These sheets can be obtained in various weights and in painted and galvanized finishes. The sheets are end-

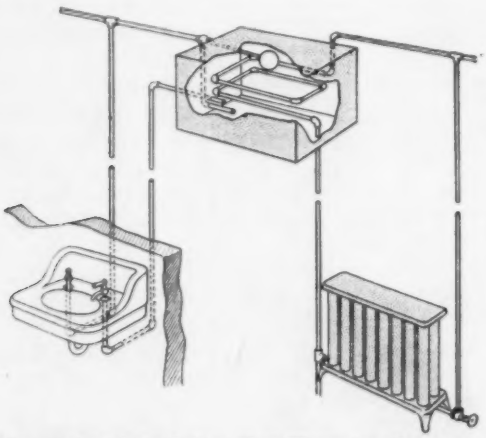
lapped about 8 or 10 in., and headers are cut in at the joints. The side lap comes on the rafters and should be about three corrugations in width. This roofing, if galvanized, should last five or six years, and if painted, from three to four years. Its cost is about $3 per square, placed. The application is shown in Fig. 14.

Canvas Roofing

This material is used mainly for second-story veranda-floor covering, and must not only be waterproof but tough enough to stand the wear of persons walking over it. There are many brands of deck canvas which can be purchased at a fancy price, but I have had very good success with the following process, using regular 10-oz. duck or canvas: The canvas is first fastened with 17-oz. tinned carpet tacks and then wetted. Before it is well dried, it is painted with white lead and boiled linseed oil to make it waterproof. After this is dried, it is given two more coats of white lead and oil paint, and one coat every year to protect it. This roofing will last for years and give perfect satisfaction. I have often seen the cloth laid in white lead and oil without wetting, but it is difficult to get it tight by this method. This roofing I have used on flat dormer roofs, as shown in Fig. 15, with most satisfactory results.

Heating Water with Exhaust Steam

While making a repair on an exhaust-steam pipe in a box factory, the office employes asked me if I could make



Connections for a Coil to Heat Water for a Lavatory by the Exhaust Steam

an arrangement for heating water without installing a hot-water boiler. After some consideration, the system was put in as shown in the sketch. I procured a plain box, lined it with galvanized sheet iron, made a steam coil with elbows and nipples, set it in the box, and connected it in the pipe system of a radiator. A ball cock and float, from a toilet flush tank, was used to shut off the water when the tank ran full. The cold water, entering at the bottom and the center of the tank, spreads out and is quickly heated.—Contributed by J. Breidenbach, Brooklyn, N. Y.

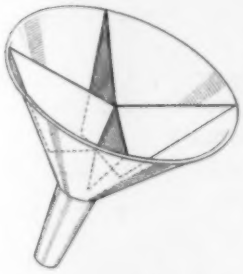
Repairing a Cracked Soil Basin

One of the children allowed the seat and cover to drop on the soil basin, which cracked the bowl between two of the little flush holes in the water channel inside, the crack running down the bowl for about 2 in. so that when the latter was flushed a stream of water gushed out on the bathroom floor. A plumber was called and he tried to repair it temporarily by putting a patch of rubber and putty on the outside and lashing it on, but when the bowl was flushed it blew off. As this happened on a Saturday the plumber said he could not install a new bowl before the following Monday. In the meantime, I hit upon a handy plan that saved me a lot of inconvenience and the price of a new basin at that time. I mixed up a cup of plaster of Paris to a fairly thick cream and injected it into the small holes near the crack with a glass dropper taken from the medicine cabinet. As the water channel was wet it thinned out the plaster, and let it flow into the crack where it could be seen oozing out on each side. The plaster was allowed to set a couple

of hours, and when the bowl was flushed not a drop of water showed on the outside. The repair stood the test for eight months and was good when a new bowl was put in.—Contributed by Mrs. P. H. Murray, Fall River, Mass.

To Prevent Whirling Motion of Liquid in a Funnel

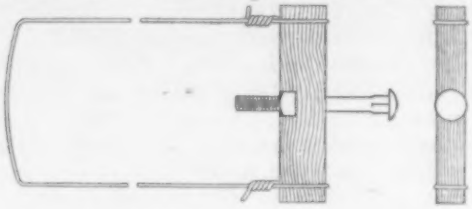
Any light liquid, if hurriedly poured into a funnel, will immediately assume a whirling motion, and if one is not careful, the resultant centrifugal force will often spill a goodly amount of the liquid. The sketch shows how any ordinary metal funnel can be provided with a piece of sheet metal so that the liquid poured into it will not at once commence the whirling motion, and the filling of the can, or receptacle, into which the funnel is inserted, can be accomplished in a much shorter time. The metal partitions in no way affect the flow of the liquid, and will save considerable expense when pouring gasoline or benzine.

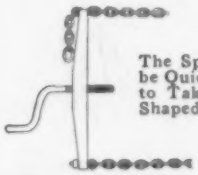


A Special Cabinetmaker's Clamp

In many cases where odd-shaped pieces are to be glued together, the ordinary clamp cannot be used, and some sort of holding device must be substituted. For such clamping I construct the temporary arrangement shown in the illustration. It consists of a piece of wood, strong enough to stand the strain and of a proper length to suit the work in hand. In the center of the wood a hole is bored to receive a bolt, and a wire loop to take in the parts to be clamped is provided. The nut of the bolt is set in the wood to prevent its turning, and the ends of the wire are looped over the ends of the wood. In operation, the bolt is turned up to make it press against the parts to be clamped.

A better arrangement of this clamp is to have a metal head, or crosspiece, and use a chain in place of the wire.



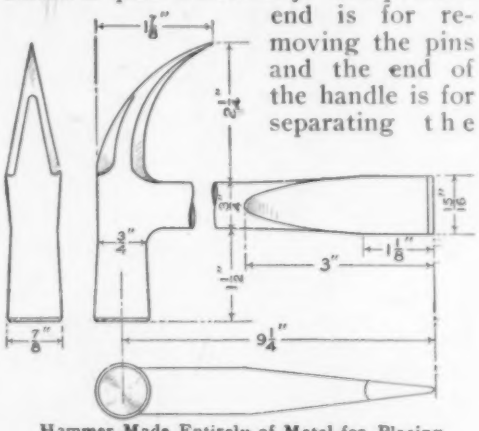


The Special Clamp can be Quickly Constructed to Take In Any Odd-Shaped Piece of Work

This makes it adjustable so it can be used for various-sized clamping operations.—Contributed by Wm. A. Robinson, Waynesboro, Pa.

Hammer for Handling Cotters

Where there are numerous cotters to remove or replace, the hammer illustrated is quite a necessity. The pointed end is for removing the pins and the end of the handle is for separating the legs after driving the cotter in place. It is constructed entirely of metal.—Contributed by Joseph K. Long, Renovo, Pa.

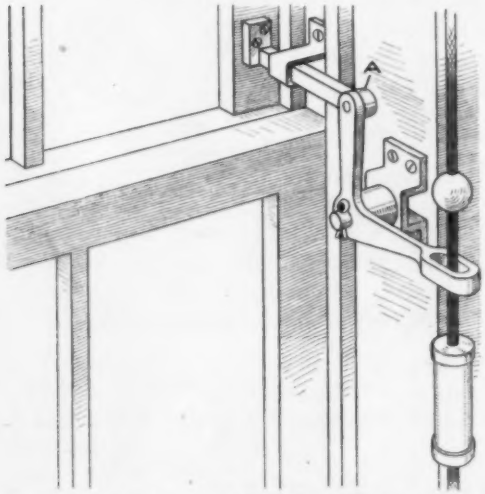


Hammer Made Entirely of Metal for Placing, Removing, and Fastening Cotters

¶ In cutting threads in the hub of any lathe chuck for a lathe spindle, do not hold it in another chuck, but screw the jaws on a perfectly true live center.

A Multiple Window Opener

In several states factory buildings are required by law to have fireproof stairways, or towers, in which the windows on all the landings can be opened simultaneously to clear them of smoke in case of a fire. The sketch shows one scheme which is used. The lower sash is fixed and the upper one is heavier than its sash weights. By pulling down on the cable, which extends through all



One of the Latches on a Window for Releasing the Upper Sash to Let It Drop

the floors, the latch A is withdrawn, and the heavy sash drops down, allowing the smoke to escape.

To Start a Cold Automobile Engine

Many older types of automobiles have carburetors of old design, and they are not suited to the low-test gasoline which is being marketed at present. It is almost impossible under these circumstances to start them in cold weather.

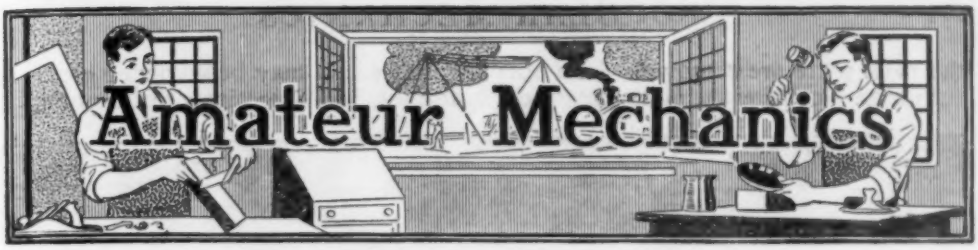
In order to make the starting easy, I tried various means and finally hit on an infallible cure. The manifold was wrapped with a thin layer of asbestos paper, on which was wound a number of turns of nichrome resistance ribbon, and the ends were fastened with asbestos cord. A length of lamp cord was spliced to the two ends of the ribbon, and an attachment plug fitted to the lamp cord. When this was plugged into a lamp socket, and the current turned on, the pipe was made quite hot in one minute, and the motor readily started without priming. It formerly took about half an hour to warm up the motor with hot water. Of course, it is necessary to have current for this way of starting and a little experimenting will be required to determine the proper amount of resistance wire to use, according to the voltage.—Contributed by Chas. C. Heyder, Hansford, W. Va.

Extra Push Button for the Door Latch

In apartment houses fitted with an electric latch on the front door, the push button for working it is usually placed in the kitchen, which is obviously the place for it. If the apartment is long, it becomes tiresome when no one is in the kitchen to walk from the front to the back, every time the bell rings, to let a visitor in. This can be avoided very simply by fitting another push button in any convenient place in the front of the apartment and wiring it up in parallel with the kitchen button. No new battery is needed, just a length of double bell wire and the new push. The connections are shown in the sketch. The kitchen ends of the new wires are connected to the terminals of the old push without detaching the old wires, that is, they are put under the same terminals

Connections for an Extra Push Button at the Front of an Apartment for the Door Latch

and screwed up tightly. The front ends are connected to the new push button in the ordinary way. Pressing either button will open the latch.—Contributed by Morris G. Miller, New Rochelle, N. Y.

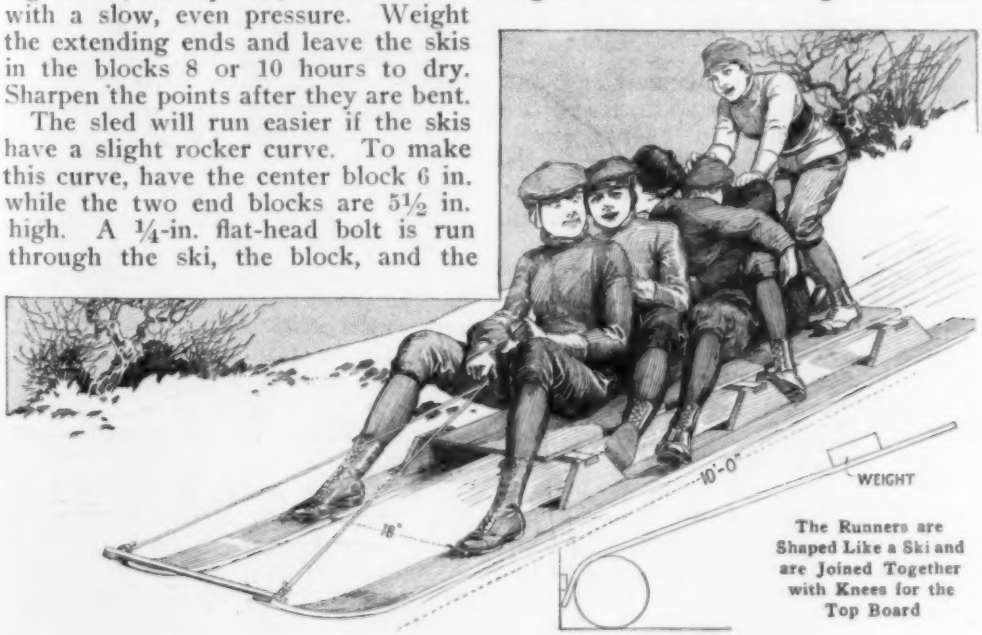


A Ski Sled

By GEORGE J. EGELBERG

THE sled is built low and wide so that it will not tip easily. The skis, or runners, are cut 10 ft. long and 6 in. wide, from 1-in. ash boards that are straight-grained. At the points where the curve is to be formed, plane off about ¼ in. on the upper side, but do not plane off any at the very tip end. This will allow the skis to be more easily bent. If it is not handy to steam the skis, put them in boiling water, and be sure that at least 1½ ft. of the points are covered. Provide a cover for the vessel, so that only very little steam may escape. Let them boil for at least one hour. A good method of bending the points is shown. When the skis are taken from the water, put them as quickly as possible in the bending blocks, side by side, and bend them with a slow, even pressure. Weight the extending ends and leave the skis in the blocks 8 or 10 hours to dry. Sharpen the points after they are bent.

The sled will run easier if the skis have a slight rocker curve. To make this curve, have the center block 6 in. while the two end blocks are 5½ in. high. A ¼-in. flat-head bolt is run through the ski, the block, and the cross strip. The holes are countersunk in the surface for the heads of the bolts. The top is made of three 6-in. boards, fastened to the crosspieces. It is a good plan to brace the tips of the skis with a 2-in. strip.



The Runners are Shaped Like a Ski and are Joined Together with Knees for the Top Board

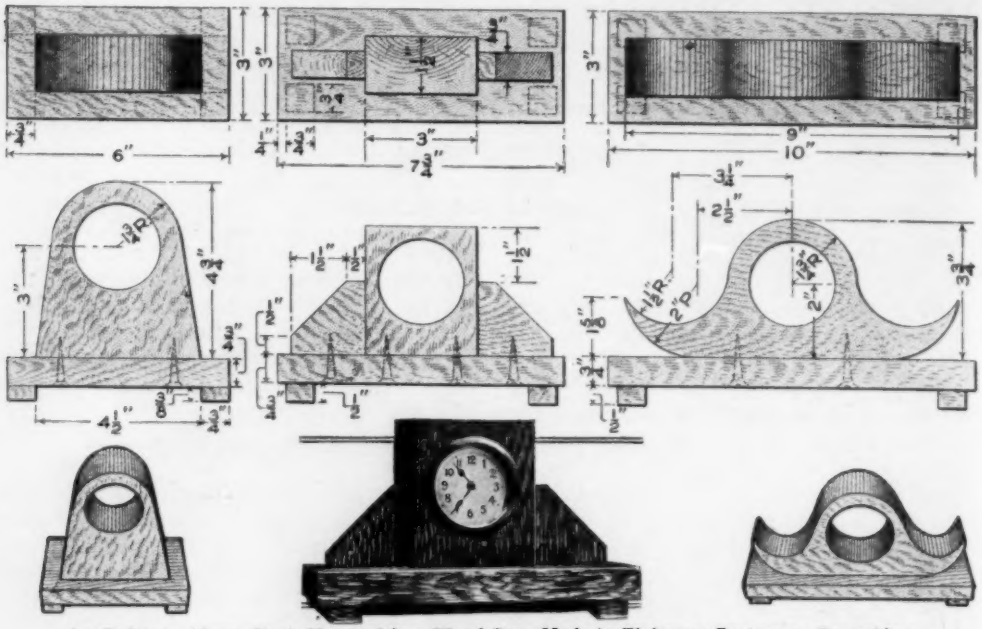
Clocks for the Craftsman

Three designs of clocks are shown, which can be easily made in oak, or other wood, that will match other furniture. The sizes of the pieces required are given by the dimensions in the drawings.

The clock is a matter of choice. Prices in most stores range from 75 cents up and the works are of the ordinary alarm-clock variety. After selecting the clock the small legs as well as

the back plate are removed. The hole cut in the wood for the clock must be a snug fit, and after placing it in position, the back plate is replaced.

The finish may be a wax or gloss, as desired, and directions for applying it will be found on the can containing the material.



An Ordinary Alarm Clock Mounted in a Wood Base Made in Elaborate Designs to Resemble a Timepiece of High Value; yet Inexpensive to Make

A Compact Galvanometer

A small portable galvanometer is one of the most useful instruments to the electrical experimenter. There are continually arising instances where it is necessary to test through and identify certain wires, for which purpose a small galvanometer and a dry cell are quite sufficient. For comparing the resistances by the well-known Wheatstone-bridge method, a galvanometer is, of course, indispensable. If the winding is made suitable, or by placing a shunt across the terminals to reduce the deflection, a small galvanometer will roughly indicate the current passing and thus enable one to compare his dry cells and eliminate the weak ones. Rough voltage comparisons may also be made by placing a resistance in series with the galvanometer.

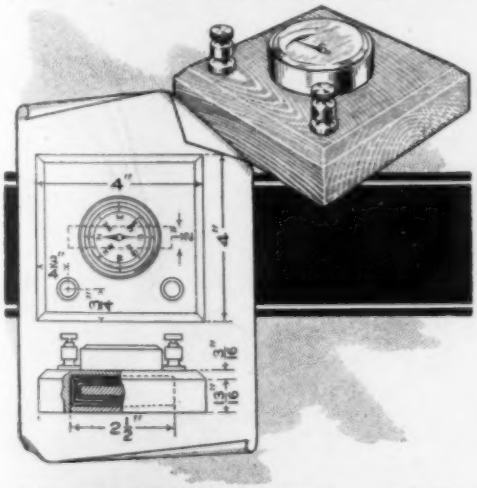
For constructing this instrument, a good pocket compass, of about 2-in. diameter, must be procured. Prepare a neat little box with the four edges accurately beveled off. On the under side of this, carefully cut a channel, about ½ in. wide and 2½ in. long, to a depth that will bring the bottom of the slot within ⅛ in. of the top of the base block. Place two binding posts on the base, as indicated, and secure the compass in place with cement, or by two very small nails put through the bottom. If the glass cannot be removed, it will be necessary to solder the nail heads to the bottom of the compass box, after having carefully removed the lacquer.

The correct wiring will depend on the strength of the current handled. It is, however, very easy to get an idea of what the deflection will be under certain conditions by merely making a preliminary trial, after winding a few

turns of any magnet or bell wire at hand around a small piece of wood, and slipping the coil so formed into the slot on the under side of the base block. The winding may be from two or three turns of heavy wire up to several hundred turns of fine magnet wire, but after one or two trials, the maker will have no trouble in determining his particular requirements.

The final coil should be wound lengthwise on a wood core, and the whole packed neatly into the slot. Connect up the ends to the binding posts, and then glue in a thin piece to hold the coil in place.

By drilling a small horizontal hole through the base, as indicated by the two dotted lines in the top view of the working drawings, and inserting a small bar magnet, 1/8 in. in diameter, or less, the instrument may be rendered independent of the earth's magnetism and used without reference to the north point. Such a controlling magnet reduces the time required to bring the needle to rest after it has been violently deflected.



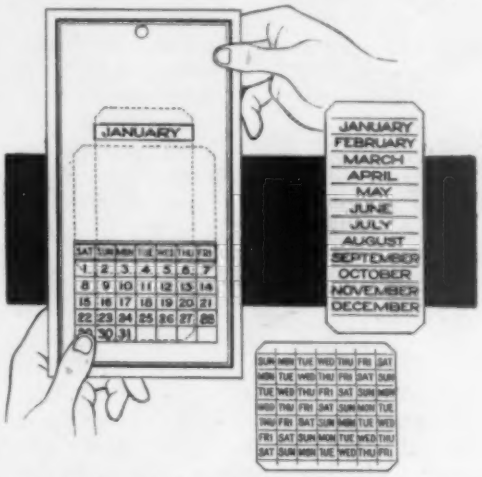
Galvanometer Made of a Compass Set on a Wood Base, with Coil and Wire Connections

---

¶Woodwork about a house, when primed with white lead made quite thin in raw linseed oil, will never blister unless moisture gets back of it. Yellow-ocher priming will cause blistering at any time up to 20 years.

A Perpetual Calendar

It is only necessary to set this calendar the first of each month, by sliding the insertions up or down, to get the proper month or week. The calendar, as it is shown, is set for January, 1916. Saturday is the first day and Friday the seventh, and so on. It is not confusing and can be read either by the day or date. If the day is known it will show the date, and if the date is known it will show the day. The illustration clearly shows the parts, which can be cut from heavy paper or cardboard.



It Is Only Necessary to Change the Sliding Pieces to Set the Calendar for Each Month

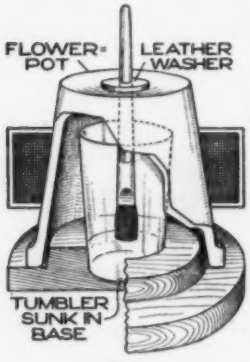
---

Heater for the Experimenter

A convenient small heater for heating liquids in experimental work, and even in making a hot drink where there is no gas, can be readily made from an ordinary oil lamp and a small round can, having a crimped-on head or bottom. The can should be of such diameter that the prongs of the lamp burner will hold it firmly in place. A hole should be made in the bottom of the can. It is then placed, upside down, on the lamp burner. If the top comes too far from the flame, cut off a strip around the edge.—Contributed by Clarence S. H. Anderson, Worcester, Massachusetts.

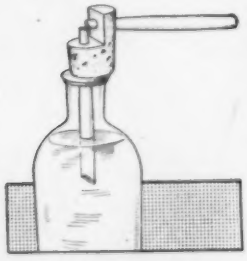
Receptacle for Shellac Varnish

A simple, inexpensive, and practical pot and cover for holding shellac varnish in the pattern shop, or at home, is shown in the sketch. It consists of a base made of wood having in the center a counterbore into which a glass tumbler, or other container, is fitted. For the cover an ordinary flowerpot is used, fitting down over a ring on the base. An accumulation of shellac around the top cannot come in contact with the cover. The brush extends through the hole in the bottom of the flowerpot and is held suspended by means of a leather washer resting on it.—Contributed by J. D. Roberts, Kenosha, Wisconsin.



Homemade Vaporizer

A simple vaporizer which can be used by designers to project their colors in a fluid spray, or by housekeepers to disinfect or perfume their apartments, can be made in the following manner: Two goose quills are forced through holes in a cork at right angles to each other, as shown. Place the vertical quill in a bottle containing the fluid to be sprayed and by blowing through the horizontal quill a very effective spray will be produced. — Contributed by Hazel Kolar, Maywood, Ill.



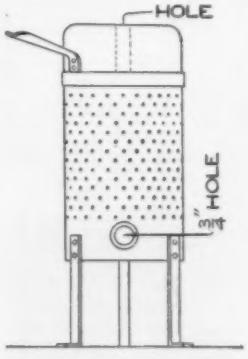
Old wringer clamps, used for holding the wringer to the tub, are very handy around a workbench.

Tooth Powder Used on Tracing Cloth

Tooth powder is an excellent substitute for the powders which are sold for the purpose of preparing the glossy surface of tracing linen to receive ink. The gritty element removes the excess gloss which prevents the ink from taking hold. A second dusting with talcum powder makes a perfect surface for inking in.

A Small Gas Furnace

A small gas furnace for melting small quantities of gold, silver, or other metals, can be easily made as follows: Procure a cylinder of stovepipe iron of the desired size, say 4½ or 5 in. in diameter, and 6 in. long. Turn in the edge of one end so that it will hold loosely a disk of iron of the same thickness as the cylinder, to form the bottom. Punch ⅛-in. holes, about 1 in. apart, all over the cylinder and the bottom. This is to allow for the escape of moisture and air. Attach three legs to the sides with rivets, evenly spaced so as to raise the bottom 4 in. In the side of the cylinder cut a hole, 1¼ in. in diameter, its center being 1½ in. from the bottom. Select a glass bottle whose diameter is 1 or 1½ in. less than that of the cylinder.



Make a putty of fire clay, and add about five per cent of plaster of Paris, and also add about a teaspoonful of vinegar, to prevent a too rapid setting. Place a mass of the putty in the bottom of the cylinder and press in the bottle after its surfaces have been well greased. The bottle should be well centered in the cylinder. Press the bottle well down, so that its bottom is on a level with the lower edge of the hole in the side. Fill in the putty to form the sides, tamping it

well all around the bottle, and build it up a little above the metal of the sides, carefully smoothing off the edge. With the fingers, or a spatula of some kind, cut out the putty in the hole to form an opening, ¾ in. in diameter. Allow the putty to set for more than an hour, and then with a circular, or twisting, motion remove the bottle. To prevent a vacuum in the bottom that will prevent removing the bottle easily, puncture the putty that lies on the disk with a hatpin, to allow the air to pass in.

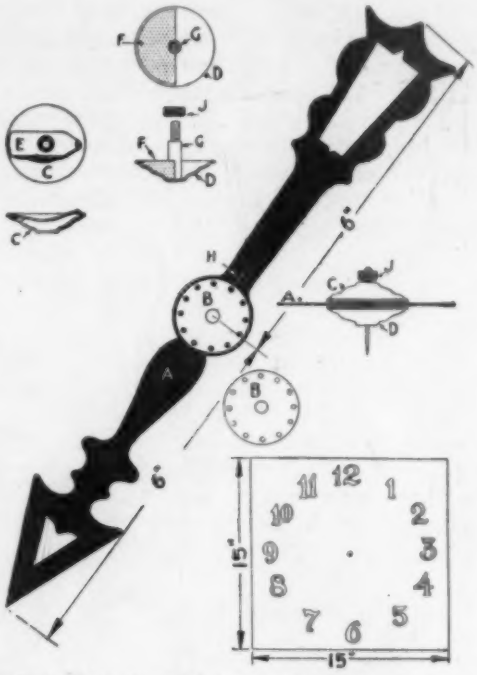
A few places will be found where the putty has not filled in properly, and these should be patched up while the filling is yet soft. The clay will probably shrink after standing for a time, and should be pressed out against the sides while in a plastic state. When dry, the furnace is ready for use.

In furnaces of this kind the jet of a large gas blowtorch is to be used. If a standard is rigged up to hold the blowtorch, it will be much easier for the operator. The jet from the pipe is thrown in the hole at the side and a crucible is placed in the furnace. It is well to make a cover similar to the body of the furnace with a hole in the center a little larger than the hole in the side.

A more efficient furnace can be made with two holes in the side, opposite each other, for using a double jet from blowtorches.—Contributed by James H. Beebee, Rochester, N. Y.

The Magic Clock Hand

The hand, or pointer, is the only working part needed to perform the trick. A clockface can be drawn on any piece of white paper, and a pin stuck in its center on which the hand revolves. The hand A is cut from a piece of sheet brass, and may be in any form or design desired, but it must balance perfectly on the axle, which passes through a ¼-in. hole in the center, or else the magic part will fail. The illustration shows a good design with dimensions that will cause it to balance well; however, this can be adjusted by removing some metal from the end that is heavier with a file or tinner's snips, or a bit of solder may be stuck to the lighter end.



Design of a Hand That will Balance Well and the Parts for Its Axle

A disk, B, is cut from a piece of sheet brass, 1⅛ in. in diameter, twelve 3/32-in. holes are drilled at equal distances apart near the edge, and a ¼-in. hole is drilled in its center. This disk is soldered to the hand where both ¼-in. holes will coincide. It is necessary to procure two washers, C and D, that are embossed, or raised, in the center, and about 1¼ in. in diameter. These can be purchased from a dealer in curtain rods, the rod parts wanted being the washers used on the ends. A careful mechanic can raise the center portion of a brass disk by beating it over a hole with a ball-peen hammer.

One of the washers, C, has a spring, E, soldered at one end, and the other carries a small projection that will engage the holes in the disk, B. The

projection can be made by driving the metal out with a center punch, set on the opposite side.

The washer D is provided with a lead weight, F, and a ¼-in. stud, G, is soldered in the center. The stud has a 1/16-in. hole drilled through its center for the pin axle. The weight is made by filling the washer with melted lead, which when cold is removed and sawn in two. One piece is then stuck in the washer with shellac. The stud is ⅞ in. long with the upper part, about ¼ in. in length, filed, or turned down, smaller, and threaded. Just below the thread, or on the shoulder, the body is filed square to fit a square hole filed in the face washer C carrying the spring. This square hole and stud end are necessary in order that both washers may turn together.

A Number is Mentioned and the Performer Gives the Washers a Twist to Set the Concealed Weight so That the Hand When Hung on the Dial will be Drawn to Point Out the Number Selected

The dial can be made of a piece of thick cardboard, or thin wood, with the numbers from 1 to 12 painted on, like a clockface. A pin, 1/16 in. in diameter, or an ordinary large pin, is run through the center so that it will project on the face side on which the hand is to revolve.

The washer D with the weight is placed on the rear side of the hand with the fixed stud run through the hole in the center of the hand; then the washer C is placed on the square part of the stud, and the nut J, which should have a round, knurled edge, is turned on the threads. This will cause the projection on the spring E to engage one of the small holes on the disk B. In turning the two washers, C and D, with the thumb and first finger of the right hand, the projection snapping into the holes of the disk B can be felt. The hand is placed on the pin of the clockface, and the washers are turned so that the weight will make it point to 12. Scratch a mark on the hand at H, also mark a line on the front washer at this point. These lines are necessary, as they enable the performer to know how many holes to snap the spring over to have the hand point at any desired number.

By reversing the hand it will point to a different number; for instance, if set for 8 and put on the pin backward, it will point to 4, and so on, with other settings. The dial can be held in the hand, hung on a stand, or fastened to a wall, and can be used to tell the day of the week, time of day, cards selected, etc. The audience can call for any number on the clockface, and the setting of the disks is an easy matter while holding the hand, or pointer, in the hands, so that it cannot be detected.

Uses for Steel Wool

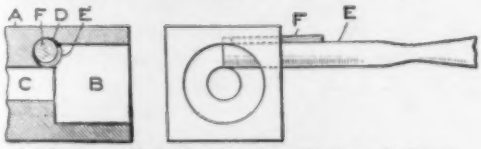
The use of steel wool in place of sandpaper when finishing off new or old work, when preparing it for varnishing or other finishes, will be found very helpful. It is put up in small packages and can be obtained in several grades of fineness. It is especially useful when removing old finishes, in and around moldings, etc., since it conforms

to irregular shapes as sandpaper will not. Put on a pair of heavy canvas gloves when using steel wool. They will keep the fine slivers out of the skin. These gloves will also be found useful when varnishing and painting.

Turning Long Wood Rods

To turn a long wood rod of small diameter is not an easy job for the amateur, and a suitable tool for the purpose is seldom found in the amateur's outfit. The tool illustrated can be easily made from materials that are always at hand. A block of hard wood, A, is first provided, and a hole, B, large enough to admit the square strip from which the rod is to be turned, is bored in the end, whereupon the hole C, which has the diameter of the finished rod, is bored through the block. The hole D is next bored at right angles to the axis of the hole C, and so placed that its edge just touches the outer edge of the hole C. This hole is to receive an ordinary gouge, and must be of such size as to receive the gouge snugly.

The gouge is ground back far enough on the under side to make the cutting edge level with its back, and then beveled off on the inside to a sharp edge. The gouge E is placed in the hole D with the cutting edge on the center line, as shown, and held in place with a wood plug, F. A little soap applied to the bore C will prevent binding.



A Block of Wood Fashioned to Hold an Ordinary Gouge for Turning Small Wood Rods

To use the tool, a strip of wood is pointed sufficiently to allow it to enter the hole C a short distance. The strip may be rotated by holding it in the chuck of a lathe while the tool is held in the hand, using the handle of the gouge to prevent its turning with the stick.—Contributed by J. A. Brearley, Washington, D. C.

Hanging Ladder for a Hatchway

A handy ladder to swing from a hatchway can be made of a solid plank, as shown. Cut the plank to the length desired and saw notches on each side to form steps. With a solid hook to fasten it in a similar hook in the ceiling, at the edge of the opening, it makes a novel yet practical ladder. — Contributed by Victor Carpenter, South Bend, Ind.

An Oilcan Stopper

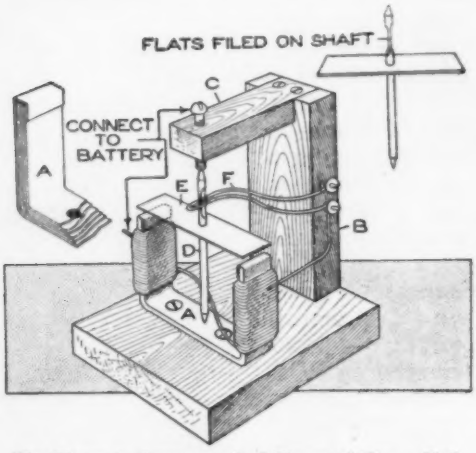
An empty cartridge shell makes an excellent stopper for an oilcan in case the original stopper becomes lost. The cap in the shell is removed and the hole enlarged with the tang of a file so that a leather thong can be inserted. A knot is tied in the thong on both sides of the base, to prevent the thong from slipping either way. The end of the thong is tied to the bail of the can.

Enamel for Steel Fishing Rods

Make a thin solution of shellac in alcohol and add a teaspoonful of Venice turpentine to each half pint, and the same quantity of lampblack for a black enamel. Scrape the bare spots on the rod and heat it slightly, to melt the shellac for the first coat. Use a fine brush and apply two or three coats, which will give a smooth, glossy, and elastic surface that will not scale or crack.

A Quickly Made Toy Electric Motor

The illustration shows a small electric motor of such simple construction that it can be easily made from odds and ends to be found in any amateur



The Motor is Constructed of Pieces of Tin, a Nail, and Some Wood Blocks

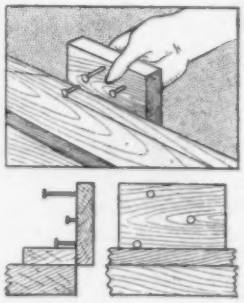
workshop. Cut six strips, ½ in. wide and 3½ in. long, from an old tin can, and bend them together into a U-shape. This forms the magnet A. The outside piece should be a trifle longer than the others so that its ends can be turned over the other ends to keep them all in place. Screw this down on a small wood base. At one side of the wood base, fix an upright, B, and on top, a light wood bracket, C, to take the upper bearing of the motor. The shaft D is simply a wire nail with the head filed off and filed to a point. Drive it through a 1½-in. length of the same kind of material as used for the magnet. This forms the rotating armature E.

Make a slight indentation with a center punch, or strong nail, exactly in the center of the base portion of the magnet to take the lower end of the shaft. For the upper bearing file the end of a brass screw off flat and make a similar indentation with a center punch, or by a few turns of a small drill. This screw should be adjusted in the bracket until the shaft rotates freely with the armature just clearing the tips of the magnet. Wind about 40 turns of fairly thin cotton-covered copper wire—No. 24 or 26 gauge is suitable—around each limb of the magnet, first covering the latter with paper, to prevent the possibility of short-circuiting. The windings should be in opposite directions so that the connecting piece of the wire from one coil to the other passes across diagonally as shown in the illustration.

The brush F is formed by doubling up one of the free ends of the windings after removing the cotton covering and fixing it firmly with two screws to the side of the upright. After attaching, it should be bent until the outer end bears lightly on the shaft. Remove the shaft and at the point where the brush touched, file two flat surfaces on opposite sides of the nail in a direction at right angles to the longitudinal center line of the armature. On replacing the shaft the brush should be adjusted so that it makes contact twice in a revolution and remains clear at the flat portions. Connect up to a battery, one wire to the screw at the top of the motor and the other end to the open end of the windings. Give the armature a start and it will run at a terrific speed. —Contributed by Morris G. Miller, New Rochelle, N. Y.

Gauge for Woodwork

A convenient gauge can be quickly made by using a block of wood and an ordinary nail, or several nails for different widths can be placed in one block. Drive the nails straight into the block until the distance between the head and block is the required distance to be gauged. The rim of the nail head makes the mark as the block is drawn over the wood surface.—Contributed by E. P. Haldeman, Balboa, Canal Zone.



Part II

BEFORE the beginner makes the attempt to ski, he should see that his complete outfit is perfectly suited to his purpose. The shoes should be nicely adjusted to fit snugly between the metal toe plates of the binding, and new holes should be punched in the straps wherever needed to adjust the harness snugly and comfortably to the feet. Many of the positions required in executing the various turns and swings may be practiced at home, that the novice may get some idea of the correct position of the feet and body assumed by expert skiers. For the initial practice outside, it is a good plan to select a frosty day when the snow is old and settled by the wind. This will introduce the novice to the sport under favorable conditions, while if the first trials are made shortly after a heavy snowfall, or upon a mild day when the snow is thawing, only discouragement will be experienced. Begin with one stick—or two if timid—and pick out an easy-sloping hill with a gradual run to the level ground. A few scattered trees and rocks will do no harm, for it is a good plan to learn how to avoid them from the beginning.

How to Turn on Skis

This and the correct manner of standing on skis are easily mastered if the beginner will but remember that the weight of the body should rest largely upon the advanced foot without bending the body at the ankle too much, or raising the heel from the ski. This is the correct position to assume when standing for a rest and for sliding, and this as well as turning should be practiced on the level. To make the kick turn, simply raise the point of the ski until the heel rests on the snow, as shown in Fig. 1. Swing the ski around by turning the point out and back until the two skis are point to heel, as shown in Fig. 2. When this, the most difficult position of the three, is assumed, raise the point of the other ski as high as convenient to avoid tripping, keep the heel down and swing the ski around over the heel of the other until both are facing in the same direction, as shown in Fig. 3. A little practice will make it possible for the novice to turn quickly, and if all turns are made with the advanced foot, when practicing on the level, no trouble will be experienced later on in attempting to turn on a steep slope. The stick is really indispensable for this practice, and while two may be used, the single stick will be found assistance enough for any active person.

When skiing on level ground the correct movement is rather more of a slide than the motion used in walking or skating. The body is thrown forward on one ski and the slide is made with both feet, most of the body weight being thrown on the advanced ski, while the rear foot is slid forward without stopping the forward travel, as shown in Fig. 4. The expert skier moves forward in long gliding steps without raising the ski, but bending the knees slightly to slide the ski ahead. The feet should be kept as close together as possible to make a narrow track and the stick used to lengthen the slide. At the beginning it is a good plan to endeavor to make a long slide with each advancement of the foot, rather than strive to take long

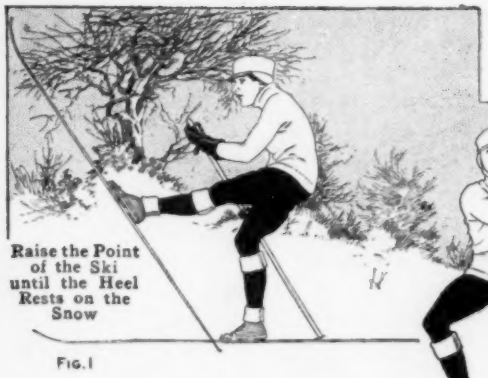


FIG. 1

step," and which is made by advancing the foot with the legs somewhat wider apart, and the skis placed at not quite so acute an angle with the hill, is more useful when climbing the ordinary steep grade and is far less laborious. If the skier knows how to handle his im-

steps. The speed of level running depends, of course, upon the condition of the snow. On hard, well-packed snow, sliding is easiest and greater speed obtained, while in deep and soft snow less speed is the rule. When skiing on the hard snow of a road, four miles an hour is the average speed, and for average level running, the skier will cover about the same distance as when walking along a good path.

FIG. 2

Swing the Ski Around by Turning the Point Out and Back
Raise the Point of the Other Ski as High as Convenient to Avoid Tripping

FIG. 3

When traveling uphill, the regular sliding gait will suffice if the slope is gradual, but when a steep grade is encountered and the ski slips backward, the skier stands quite erect, raises the point of his ski about 3 in., and slaps it down smartly, without pulling it backward or making any attempt to push his body forward with the stick. This slap of the ski makes the smooth surface of the runner adhere better than when the runner is slid forward in the usual manner. If the hill is very steep, the skier will naturally place his skis at right angles rather than permit the slipping backward. This is known as "side-stepping," and is shown in Fig. 5. In doing this, the heel of the ski must be raised clear of the snow and the upper foot lifted uphill, then the lower foot brought up to the last step of the upper foot, hence it is extremely tiring for other than a short distance.

FIG. 4

FIG. 5 The Skier Naturally Places His Skis at Right Angles Rather than Permit the Slipping Backward

A variation of this movement, which is known to skiers as the "half side

plements, side-stepping may be done backward when necessary.

The "herringbone" is another step which is much used when the skier wishes to travel up a short and steep incline. This step is made by stretching the legs rather wide apart and pointing the toes out, as shown in Fig. 6, at a decided angle, so that the knees are bent inward and the inside edges of the skis cut into the snow. A variation of this is the "half herringbone," the skis being turned out at a less acute angle. These special steps for special purposes are all useful now and then in mountain climbing, but when a long distance is to be covered, the skier will conserve his energy by mounting the hill in a zigzag fashion rather than attempting to climb straight up. The track of the skier will then resemble the course of a boat tacking through a narrow inlet against a head of wind, and while more ground is covered than when going straight up the steepest part of the hill, progress is faster and much hard work is avoided.

The Skier Runs Straight Downhill on One Ski and Uses the Other as a Brake FIG. 9

On Hard Snow the Edges of the Skis may be Used to Check the Speed FIG. 8

When Running Downhill One Ski should Be in Advance of the Other a Few Inches FIG. 7

The Herringbone is Much Used When the Skier Wishes to Travel up a Short and Steep Incline FIG. 6

When running straight downhill, one ski should be in advance of the other a few inches, and the skis must be held quite close together so that they touch, or nearly so, as shown in Fig. 7. To make a narrow track, most expert skiers hold the knees together with the back knee slightly bent. However, the body should be perfectly and easily balanced. This is done, more or less intuitively, by beginning the run with the body thrown on the advanced foot, and when full speed is attained the weight automatically shifts to the rear foot. The novice will find it difficult at first to keep the skis together, there being an almost uncontrollable desire to separate them to

gain a better balance. A good track will come with a little practice, but if the skis are too short, or made without a groove, even an expert would be

The Christiania Swing is Accomplished by Pressing with Both Heels at the Same Time While the Stick Digs Well into the Snow Above

FIG. 10

compelled to keep his feet a trifle apart and make a double track in order to keep from falling.

When making the start preparatory for coasting downhill, the novice may, if the slope is moderately steep, face in the desired direction and assume the proper position by supporting himself with the stick. On most very steep slopes, where the best coasting is to be had, this is quite out of the question, and the skier must step around quickly by moving the lower ski first. This will be somewhat difficult to do until the novice gains more confidence, which will quickly come after a little practice, and it is a good plan to practice starting from the slope without the aid of the stick to anchor the body. Owing to the fact that the skis do not reach much speed at the start of the coast, even the slow novice will have plenty of time to make the turn and face in the right direction before much speed is attained. A comparatively crouching position, secured by bending the knees and the body at the waist, will much lessen the liability of a fall forward. This position enables the skier to control the balance of his body with more certainty, and especially when coasting on a hill where patches of ice, or crusted snow, and soft spots of unpacked snow are encountered, a condition usually found wherever skiing is enjoyed. When coasting, the stick, or sticks, should be firmly grasped at the upper end with the looped thong, or strap, over the wrist, and the end dragging behind. Balancing is done entirely at the waist, and for straightaway running, the weight of the body will rest largely upon the rear ski. The long running surface of the ski will carry the skier over many bumps and hollows without disturbing the balance of the body or causing a fall, providing the novice does not lose his nerve. It is necessary to practice on rough and uneven ground if the skier desires ever to attain much expertness, and plenty of falls must be expected, but not dreaded by the beginner. A fall on skis is by no means fraught with danger, and one may fall with impunity providing all muscles are relaxed. Many beginners find falling the easiest manner of stopping, but this should not be necessary, providing the hints given are well understood and practiced. However, the novice should have no fear of falling if he wants to become proficient on skis, and to offset any timidity, which so very often causes the novice to lean backward and fall in this direction, it is a good plan to lean well forward to check this natural tendency. Getting up after a fall is easily enough managed if the head is pointing up the slope, but when the position is reversed much floundering is necessitated. It would seem that this would be obvious to all, yet the majority of beginners often forget it altogether.

Braking with the stick is only effective when the body is properly balanced, and the stick is kept well forward and as nearly vertical as possible.

Straddling the stick, sitting upon it, or leaning backward on it held at an angle, are slovenly methods which every novice should avoid.

The "snowplow" is most largely used by all good skiers for braking, stopping, and turning. This is accomplished by stretching the legs wide apart and at the same time turning the toes in as much as possible, thus presenting the side of the ski to the snow and retarding the speed. Aside from straddling the legs wide apart, the novice will have no trouble in learning this useful knack. For the first practice, pick out a fairly steep hill road, or a hillside where the snow is old and not soft. Begin the run as for coasting, and when good speed has been attained, spread the legs wide apart, turn the toes in and endeavor to control the speed with the skis rather than depend upon the stick. On hard snow the edges of the ski may be used to check the speed, but on ordinary soft and well-packed snow, the runner may be kept quite flat. This is well shown in Fig. 8.

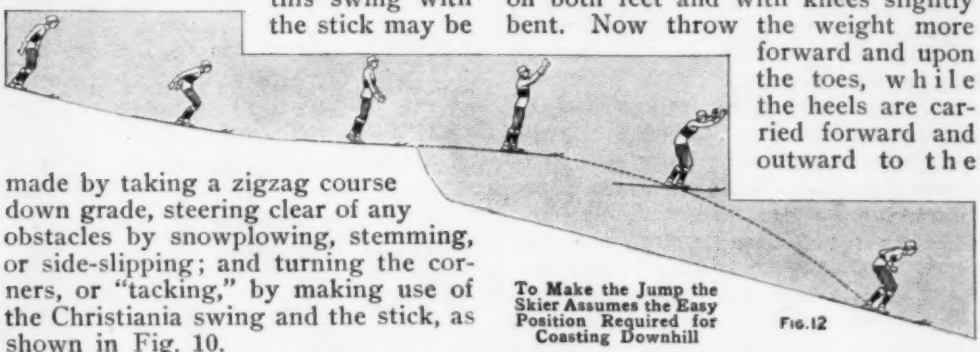
The knack of "stemming" is a variation of the snowplow, inasmuch as the skier runs straight downhill on one ski, and turns the heel of the other ski outward and downward and uses it as a brake, as in Fig. 9. This is a very useful movement, and is largely used when coasting down steep slopes, and when one has learned the knack of it, stemming will serve for braking and steering, and is useful for stopping by turning the skiing course uphill. To learn it, select a steep hillside, coast down at an angle, with the feet a trifle apart, and endeavor to retard the speed with the stick and turn the heel of the lower ski outward. This makes the turn and the skier faces uphill and comes to a stop. By turning the heel of the lower ski outward and the heel of the upper ski inward, the skis will travel downhill with a sort of snowplow movement. When practicing these movements, the beginner should endeavor to use the stick as little as possible and learn to depend upon the skis for controlling the speed.

The "side slip" is useful on steep slopes, and is done by turning the skis so that the runners are at a decided angle to the course traveled. This affords the maximum braking by the skis alone, and is especially effective when combined with the braking done with the stick. Side-slipping may, of course, be done while the skier is traveling forward, by keeping the skis close together so that the edges almost touch. While this movement checks the speed in much the same manner as stemming, side-slipping is less tiresome, since the weight of the body gives the required braking effect, while, in stemming, the muscles are called upon to keep the heel pressing outward.

FIG. 11

Closely akin to side-slipping is the Christiania swing with the stick, which is accomplished by pressing with both heels at the same time, while the stick digs well into the snow above. This variation of the side slip is easily done, and the skier is turned sharply

uphill to come to a quick stop. When a sharp hill is met with, that is considered a bit too steep to take straight, this swing with the stick may be made by taking a zigzag course down grade, steering clear of any obstacles by snowplowing, stemming, or side-slipping; and turning the corners, or "tacking," by making use of the Christiania swing and the stick, as shown in Fig. 10.



To Make the Jump the Skier Assumes the Easy Position Required for Coasting Downhill FIG. 12

The "S"-turn may likewise be used for turning corners, without the necessity for stopping to make the ordinary kick turn. A good way to learn this useful movement is to run straight downhill in a snowplow position, reduce the speed to a comfortable walking pace with the stick, and stem with the ski. If this is done with the right ski, the "S"-turn is made by throwing practically the whole weight of the body on the right ski, at the heel, and pressing it outward while the stick is carried ahead and below the skier. If the heels are kept well apart, and the toes close together, the skier will have no trouble about swinging around in a curve and be off on the other tack. About the only difficulty in making the "S"-turn is the position of the body, which must be thrown somewhat out and away from the hill. To the novice this at first seems to invite a fall, but a few trials will soon prove that the weight of the body must be thrown on the foot which circles on the outside of the curve, hence the apparently unnatural position of the body is essential for a good turn. By bringing the stick well forward and downhill, the skier uses his staff as a pivot upon which the turn is made.

The Christiania swing, made without the stick, is a favorite with expert ski runners when running on rough and steep ground and is a good way of stopping. The swing may be made both to the right and left. To make it to the right, keep the skis close together, the right a trifle in advance, with the weight of the body equally on both feet and with knees slightly bent. Now throw the weight more forward and upon the toes, while the heels are carried forward and outward to the left. The body must lean to the right —the direction in which the swing is made—and twisted somewhat at the waist; and the sharper the turn, the more the body must lean sideways to keep the balance. The swing to the left is made in the same fashion, only the left ski should be a trifle advanced and the body thrown to the left.

The Telemark swing is more difficult to master than the Christiania swing, because it is done on one foot, or ski, instead of using both, and as it is less powerful than the latter, it is of far less use for stopping. To make the Telemark swing to the right, assume the regular position for downhill coasting, and, advancing the left foot, turn the ski so that it rests on its edge as when making the snowplow, throw the body to the right and lean in toward the slope to keep the balance. To make the swing to the left, advance the right foot, turn the body to the left and lean as before. This is shown in Fig. 11. The Telemark turn is, in fact, made in the same manner as stemming, and the sharpness of the swing rests altogether upon the quickness with which the heel is thrown outward and the body turned in the direction the skier desires to swing. The swing is made upon one ski, and the key to the whole swing is the knack of raising the heel of the other foot off its ski until it rests upon the toes. That this is hard to do goes with the telling, and the novice should first acquire the knack of bal-

ancing by running straight downhill with the weight thrown on one foot. When this can be done, and not before then, the skier is ready to practice the turn. The Telemark swing, like all other turns, is easily acquired at slow and moderate speeds, and becomes more and more difficult to make as the speed is increased and the turn is made more sharply and quickly.

Jumping on skis is one of the most exhilarating winter sports, and it is a pity that it is not more popular wherever a medium-heavy fall of snow occurs. While touring on skis across a hilly country, there will be many natural jumps to encounter, for drifts, stumps, rocks, and other rises in the ground, when well covered and padded with snow, make good jumping-off places. While but a few skiers may have attempted such high leaps as the famous Holmenkollen, Fiskertorpet, or Foldberg, all who have done much ski running have done a little jumping, since, when running downhill, an unexpected dip is often encountered, and a rise in the ground causes the skier to leave the ground for a short distance and alight several feet below. Doubtless the skier has enjoyed the flying-like sensation of this brief moment, and very likely he has climbed the hill to repeat the jump. Moreover, this has very likely demonstrated that the distance of the jump depends upon the height of the dip, the speed of the skier passing over it, and likewise upon the spring of the body on the take-off. In making a jump of any height, the take-off may be level, pointing up or even downhill, and constructed with framework extending out from the hillside, or consist merely of a large boulder, or a pile of logs, well padded with snow. The height of the slope chosen will, of course, regulate the distance of the jump, and the place where the jumper alights should be fairly steep, since, if the skier lands upon a level place great difficulty will be experienced in keeping the balance. Therefore the usual jumping hill, where jumping competitions are held, is provided with a 30°, or steeper, landing place, and this merges gradually into the outrun, or slope, connecting the hill with the level ground below.

For the safety of the skier, the snow should be firm but not icy or hard, and this is easily done by packing the

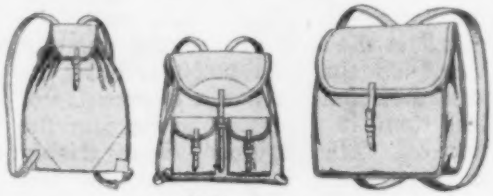


Fig. 13
Each Member of the Party should be Provided with a Ruck Sack of Good Capacity

snow down well by means of the skis. A good, thick padding of snow is of course essential, and a thickness of 2 ft. is really needed at the landing place and at the take-off. In our more northerly sections, plenty of snow usually falls, but wherever a few sportsmen get together, it is an easy matter to shovel sufficient snow to prepare a good and safe jumping hill.

To gain confidence and acquire some useful experience in jumping, the novice should practice leaping from a 2-ft. rise and gradually increase the height of the take-off by piling more snow upon it to increase its height. One or two packing cases firmly placed upon a smooth, steep hillside, and well padded with 2 ft. of well-trodden snow, will make a nice take-off. For the beginning the take-off may point slightly downhill or be fashioned level, and as the skier becomes more proficient, snow may be added to the edge so that the take-off will send the jumper well up into the air.

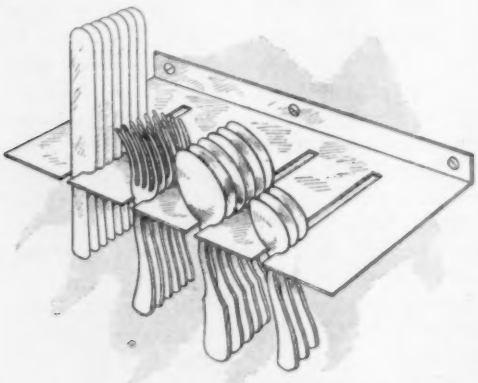
The knack of jumping is nothing more than balancing the body upon alighting, and the steeper the landing place the easier it is to keep the balance. To make the jump in good form, the skier assumes the easy position required for coasting downhill, as shown in Fig. 12. When within a dozen yards of the take-off the body is lowered until the skier is in a crouching position with the arms extending back as in the act of jumping. Arriving within a couple

of yards of the dip the body and arms are thrown forward, which transfers the weight of the body upon the toes, and the body is straightened up and the arms are raised not unlike the wings of a bird, to keep the perfect balance of the body. The straightening up of the body, known to skiers as "the sats," is the leap proper and must be timed so that the body assumes an erect position when the jumper is not less than 12 ft. from the edge of the take-off. The beginner will invariably jump too late, but after a little practice, and profiting by numerous mistakes, the take-off will be timed correctly. Alighting after a jump is best done by advancing one ski a trifle to keep the balance, and bending the knees a bit to lessen the impact. The jumper ends with the Telemark or Christiania swing.

When taking tours of any length on skis, each member of the party should be provided with a ruck sack of good capacity. That of the expanding type, made with two outside pockets, and with gores at the sides, is a good, sensible pack. It should be made of 8-oz. waterproof khaki and fitted with shoulder straps of good width, to prevent chafing the shoulders. Leather ruck sacks are sometimes used, but are heavier in weight and more expensive, but no better. One member of the party should carry some kind of repairing outfit, consisting of an awl, a length of leather thong, a few spare straps, and a stout cord, or string. These sacks are shown in Fig. 13.

Knife, Fork, and Spoon Holder

The holder is made of a piece of sheet copper of sufficient thickness to support the number of pieces of cut-



The Holder Keeps the Cutlery in a Position for Easy Selection and Grasping

lery used. The piece is notched to admit the different pieces, and its back edge is bent at right angles to provide means of fastening it to a support, a wall or the back of the kitchen cabinet. It will save space, as well as time, since it is much easier to grasp one of the articles when wanted than if they are kept in a drawer.—Contributed by L. E. Turner, New York City.

Making Round Rods for Fish Poles

In looking forward to the enjoyment that may be had in the spring, it is well to prepare and overhaul the fishing apparatus or the shooting equipment. In doing so, it may be necessary to make a joint for the fish rod or perhaps a rod for the gun. These can be easily cut if they are sized and run through holes made in a piece of thin metal as follows: Make several holes of the desired sizes in a steel plate, and ream them out with a rather dull taper reamer, so as to leave a bur on one side. This bur should be filed down almost level with the surface of the metal, leaving the edges flat and sharp. If a rod of wood from which the article is to be made is put in a hole and drawn through from the opposite side to the bur, a nice round rod will result. As the rod becomes smaller, use a smaller hole until the required diameter is obtained. A saw plate that is not too thin is about the proper thing to use for the steel plate. It will be necessary to draw the temper to make the holes, but it is not necessary to retemper it after the holes are made.

¶Celery keeps well in a small box of dry sand.

A Magic Cabinet

The performer calls the attention of his audience to a cabinet mounted on short legs and having doors in the front, back, and top. The back door is opened, then the top and front, and an arm is thrust through to show that the cabinet is empty and without double doors or double walls. The performer also puts his wand beneath the box to show that there is no deception there. The doors are then closed, except the top, and reaching down, he takes out any number of articles, from handkerchiefs to rabbits, and then the front door is opened to show the box is empty, but upon closing the front door again, he is still able to produce articles until the supply is exhausted. Wonderful though this trick may appear, it is very simple, and if a person is handy with tools, it can be made from lumber taken from a packing box.

To make the cabinet, nail together, in the shape of a rectangle, two pieces, 16 in. long, 14 in. wide, and ½ in. thick, and two pieces 14 in. square and ½ in. thick. To one of the latter pieces fasten four legs, one at each corner. In the opposite piece, or the top, make an opening in the center, 8 in. square. This opening is covered with a door 8½ in. square, supplied with a knob to open it easily. A piece, 16 in. long and 14 in. wide, with an attached knob, is hinged to the front, for a door; also another for the back hinged in the same manner and with a knob. In the back there is a cutout made, 9 in. long and 7 in. wide, in the center. In this opening a swinging box is hung to hold the articles taken from the cabinet. The swinging box is made of two pieces, 9 in. long and 7 in. wide, and two pieces about ½ in. larger each way, nailed together on ends, cut triangular. This box is hinged in the opening so that it will swing in or out as desired and show a panel on either side of the door. The front door should have a panel nailed on each side of equal size, to make both doors appear alike.

After loading all the things desired to be shown in the triangular box, start the trick by pushing this box into the cabinet and showing the outside; then open the back, and in doing so, push the triangular box out as the door swings back and away from the audience. This shows that there is nothing to be seen but the panel. Open the front door and top, and the cabinet will appear empty. Close both front and back doors, and in making this change, push the triangular box in, and begin to take the things out through the top door.

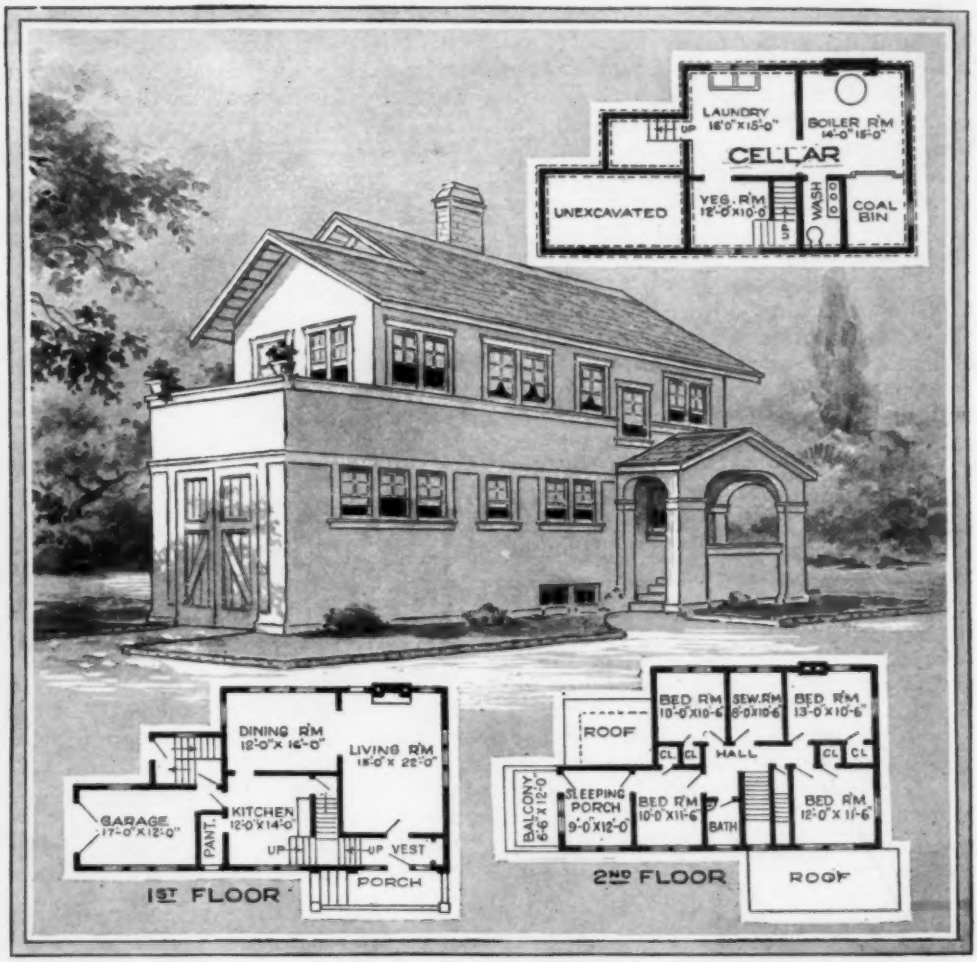
Open the Front Door and Top of the Cabinet and It will Appear Empty

By careful construction the cabinet can be made so that the doors will open freely and the triangular box swing easily so that it will not be seen in operating it. With a clever performer this trick is without an equal, as many variations can be made in the performance.

Countersinking a Hole Smoothly

When a hole in a piece of steel, iron, or brass is being countersunk, the drill usually chatters, making the countersink rough. Where a smooth hole is required, it is best to make the countersink first and drill the hole afterward. By doing so the hole will be perfectly smooth. — Contributed by Chas. G. England, Washington, Pa.

CEMENT-STUCCO FARMHOUSE WITH GARAGE



DESIGNED BY HERBERT A. SHEARER, CHICAGO

THIS attractive farmhouse is designed with the idea of meeting all the requirements of farm life, including the housing of the help, at as low a cost as possible. The building is of frame construction with cement-stucco covering, while the foundations are of concrete. It is a full two-story structure with basement and with attic for storage. With soft wood used as interior finish, it is estimated to cost about $2,500 without the heating plant. An unusual feature is the garage built into the rear of the house. The entire first floor is given over to the kitchen and pantry, living room, dining room, vestibule, and garage. On the second floor are four bedrooms, a sewing room, bath, and sleeping porch, the latter opening on a balcony. Each of the bedrooms is provided with ample closet room, and all the rooms on this floor with the exception of the sleeping porch have direct access to the hallway. The basement contains the heating plant, laundry, cold-storage room, coal storage, and a wash room for the workmen. The wall, steps, and floor of the front porch are of concrete, while the pillars and gable, like the remainder of the house, are of frame covered with cement-stucco. The building is roofed throughout with shingles.

IN accordance with the editorial policy of this magazine never to accept compensation in any form for what appears in our reading pages, and also to avoid all appearance of doing so, we are obliged to omit the name of the maker or the seller of any article described. This information, however, is kept on file and will be furnished free, by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. [Editor.]